# ARMY ORDNANCE

The Journal of the Army Ordnance Association — Now in its Twentieth Year of Publication

Pledged to Public Service in Effecting Industrial Preparedness for War as Our Strongest Guaranty of Peace

Volume XX JANUARY-FEBRUARY, 1940 No. 118

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THE Army Ordnance Association is a national organization of American citizens pledged to industrial preparedness for war as our nation's strongest guaranty of peace.

The Association endeavors to keep alive an interest in and knowledge of the design, production and maintenance of munitions. Other than a few manufacturing arsenals—six in all—there is no peace-time industry for the production of ordnance. Should war unhappily come again, industrial America will be called upon to produce munitions in great quantity and of intricate and unusual design. In an emergency, time will not permit careful study or long preparation for the production of munitions. The problem is one of vital concern.

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The Association is devoted solely to the national defense; it has no commercial interests, no political alliances, and no religious affiliations. It is not operated for profit: its income is expended in furthering its aims. Its officers and directors serve without remuneration. Membership, to which American male citizens are eligible, is four dollars a year. (Application on request.)

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The objectives of the Association as set forth in its Constitution are:

To assist in effecting industrial preparedness for war as being one of the nation's strongest guaranties of peace;

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To promote mutual understanding and to effect coöperation with American scientists, inventors, engineers and manufacturers in civil life and the Regular and Reserve officers of the Ordnance Department;

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*Signal Corps, U. S. Army*

On the Target

ARMY ORDNANCE

Volume XX JANUARY-FEBRUARY, 1940 No. 118

# Changeless War

## *Modern Methods Have Not Altered the Fundamentals*

By Gen. George C. Marshall*

IT MIGHT be well, at the outset, to submit a few comments regarding the present discussions of the great changes that have taken place in the manner of making war, considering, for example, what has happened recently in Poland. I will preface these comments with a personal experience, if I may be permitted, which was to me a lesson in the matter of getting down to fundamentals, believing, as I do, that they are usually unchanging.

I sailed for France with the 1st Division in June 1917. Filled with recruits and newly organized, the division went into the line that fall, and as a complete division, entered the sector north of Toul on the Saint-Mihiel front in January 1918. We occupied a locality in which there had been no active fighting for almost three years. It had been maintained on the same basis until in some respects it was almost like a hotel, with divisions coming and going as the guests of the permanent sector organization. The troops were largely disposed in the forward zone of the sector, and I recall that the principal dugouts were under the parapets of the front trench.

We had been there but two or three weeks when we received from the Intelligence Bureau of the French Army a description of an expected assault to be made by German forces. These had been reënforced heavily with divisions drawn from the collapsed Russian front. The reported nature of this new attack, termed a "maneuver of rupture," was such that it caused the French High Command to direct a complete reorganization of the defenses—from that of a shallow nature to one of considerable depth. This meant the complete change of a system which had existed for nearly three years. It meant, in brief, that a regiment which had occupied a deployed depth of about five or six hundred yards would be disposed over a depth of a mile or more, and that the regiments, the companies, the individuals, would be much more widely dispersed; that a great many machine-gun emplacements, previously located along the lines of trenches, would have to be relocated in staggered formation of great depth.

To the 1st Division it meant a tremendous planning problem, and for the troops, hard manual labor and much exposure to the weather of that bitter winter of 1917-1918. Snow was deep on the ground. Every move we made could be traced readily by the tracks of vehicles and of men on foot as well as by the signs of extensive excavations. Construction was started, and the men worked very, very hard. They suffered extreme hardships because of the inadequacy of the arrangements we could make for their shelter in the newly deployed positions in depth, but they did their work uncomplainingly. Then, when we were about half through with this program, the great German offensive of March 21, 1918, broke against the right of the British Army.

THE 1st Division was hurriedly withdrawn from that sector and sent to Picardy. As its trains were arriving northwest of Paris, I personally reported to the headquarters of the group of French armies in which we were to serve. There I was informed that the system of organization in depth which we had just been carrying out on the Saint-Mihiel front had since been modified greatly as a result of experience of the recent heavy fighting. I was given the new method for taking up dispositions in depth which we were to follow as we went into the new sector on ground but recently occupied and without trenches.

We started work on the defenses under this new arrangement. Again the men worked in the cold and mud of early spring in Northern France, but just as they were well engaged in it, another German offensive broke, this time down the Valley of the Lys. Two weeks later new instructions were received for further modifying the method of deployment in depth. Once more we were forced to abandon the results of work that had been laboriously accomplished.

The troops were very tired. They had had no relief since early January. They had endured the cold and the mud, the snow and rain of that bitter winter. It is true that they had not been engaged in an active operation, but they had been under such heavy fire that about three or four thousand men were casualties. Nevertheless, every man set about this newest task of reorganization in a fine, soldierly spirit. And then we entered into the Cantigny operation, where we suffered heavy losses due to a series of desperate German counter-attacks and violent artillery reactions. Simultaneously with that fight came the German attack on the Chemin des Demes which thundered down to Château-Thierry—to make of it historic ground for our Army. And then once more, two weeks later, we received a new set of instructions completely modifying in depth the organization we were then in the process of completing.

I recall that in our reply to these new instructions we notified the French headquarters that we could do one of two things: We could fight or we could dig, but it was no longer possible for us to do both!

We now come to the climax of this series of events: That last modification, which was a modification of previous modifications, though written in French, was expressed literally in the language of the Field Service Regulations of the United

*Chief of Staff, U. S. Army.
This is an address delivered at the Twentieth Anniversary Dinner of the Association, the Willard Hotel, Washington, D. C., October 11, 1939.

States Army in 1914. In other words, there had been no change in fundamentals, but during three years of trench warfare those fundamentals had been lost sight of, and now in that critical summer of 1918, we were back again to first essentials of warfare.

To me that was an impressive lesson, and since then, whenever changes are proposed, modern theories advanced, or surprising developments brought to my attention, I automatically search for the fundamental principle involved in the particular matter at hand.

Many of the discussions at the present time, in relation to what we have learned of the occurrences in Poland, seemingly proposed new fundamentals as a basis for warfare. I might comment here on the fact that the American public is remarkably well informed on events in Europe. But our knowledge at the present time, official and public, is superficial. However, it does appear that much of the procedure in Poland was merely a modification or a speeding up of the time-honored methods of making war, especially adapted to the terrain, the season of the year, the character of the people, and the geographical set-up.

YOU undoubtedly have read of the concentrations we are inaugurating for the mobile troops of the Regular Army. Some four Infantry divisions and one Cavalry division, together with the necessary corps troops, a few of which now exist and others of which are being organized, are being collected for special training. As soon as those divisional concentrations have permitted officers and men to gain familiarity with the new organizations, corps formations of three or four divisions, with the special troops concerned, will be carried out in large maneuvers to give the higher command experience with operations of large formations under modern conditions.

These will be the most extensive maneuvers ever attempted by our Army in time of peace. It will be, in effect, a great college of leadership for the higher officers, not only of the Regular Army, but of the National Guard and the Reserve Corps. It will provide a splendid practical schooling for the young products of the R.O.T.C. in the Reserve Corps, and I hope it will lead to a policy for an annual concentration of a force of this general character of regular troops. It will enable us to keep abreast of the technique necessary for the handling of large bodies of troops and to keep before the public the evident necessity for maintaining a balanced force sufficiently complete for immediate employment.

In this connection I would like to make some comments which I think are rather pertinent. It has seemed to me, from a study of the hearings before Congress, that the Army has suffered continuously from lack of understanding by the public, and to a certain extent, by the Congress. The responsibility for this, in my opinion, rests largely with the Army; it is due to the manner of our presentations and our use of military-technical terminology. At present, an army involves so many complex and varied activities and technical requirements that it is difficult even for a professional soldier to keep in close touch with the entire problem. I must confess that in going into these matters in the War Department I frequently have difficulty in understanding just what a particular staff officer is discussing, so far as all the related factors are concerned. If that is so in my case, it is probably much more the case with members of Congress and must involve a still greater misunderstanding by the general public.

We suffer from another disadvantage. The Army, I might say, is not photogenic. The more efficient it is, the better its organization, technique and deployment, the more nearly it is invisible, except for the Air Force and the mechanized units. For that reason, these last two forces have less difficulty in convincing Congress of the necessity for appropriations. If we could show pictures of the mobile army approximating the beautiful photographs of columns of battleships or destroyers bucking a heavy sea, I think we would have less trouble in developing our military program for the national defense!

WE RECENTLY had an excellent example of the force of such publicity. Several years ago, publications were filled with photographs of the horrors of bombing women and children in China and in Spain. Promptly public pressure developed, Congress responded, and we finally received long-overdue appropriations for airplanes and antiaircraft matériel. But until the war photographs had reached the public, there was indifference or great reluctance to respond to our urgings for such equipment.

There is another factor—a most important factor—which pertains to our geographic location. The American people naturally are loath to see large appropriations made for war purposes, believing extensive defensive measures unnecessary due to our geographical location between two great oceans. The Atlantic and the Pacific are of tremendous value to our defensive situation, but they are not impassable.

In reviewing various hearings before committees of Congress and the published articles stressing this, that, and the other military development, I have come to the conclusion that if we can find simpler terms for expressing our problem—if, for example, we can settle on a single unit, such as the army corps of two or three or four divisions, with the necessary corps troops—heavy artillery and antiaircraft, observation, engineers, squadrons, truck trains, medical troops, signal battalions, and all the supporting elements essential in battle—if we can focus on an army corps as our unit of measurement, as our basis of calculation, then I believe we will have much less difficulty in making our problem understandable. Such a policy, as far as matériel is concerned, should offer a simple basis of calculation, and the fundamental consideration of the problem, as it relates to the members of the Army Ordnance Association, is the basis for calculating actual requirements. So, if we take the army corps together with the proper percentages for other related forces as a medium of measure—a yardstick, as it were—in so far as the ground army is concerned we will have a simple problem of arithmetic for the determination of the requirements in personnel, matériel, and reserves for any multiple of that force.

Incidental to the concentration we now are bringing about in the South, we have made a step forward in the reorganization of our Infantry divisions. At present we will reorganize only divisions of the Regular establishment, leaving the question of reorganizing the National Guard divisions to a later date.

When it comes to corps troops, however, we will have to create a number of new units. This can be done only if we are permitted to expand to the authorized peace strength of both the Regular Army and the National Guard. When and if we reach such strength, we can provide four more divisions in the Regular Army, another group of corps troops, and

some important special troops for the GHQ reserve, as well as reënforcements for foreign garrisons. In addition, we will be able to create the necessary corps troops that logically should exist in the National Guard.

I BELIEVE that our military personnel problem in this country is often misunderstood by reason of the fact that we have such a large portion of the Regular Army on foreign service. We might characterize these last posts of duty as naval garrisons, since they guard vital naval installations such as the Panama Canal, Pearl Harbor in Hawaii, and the naval defenses we are developing in Puerto Rico as an out-guard of the Panama Canal. There thus is left within the continental United States only a small combatant force of the Regular Army for which we have found it difficult to arrange adequate training—not to mention the training of the senior officers of the National Guard and the Reserve Corps who would constitute the major portion of our war army. As a matter of fact, the National Guard must be considered as the first line of the Army since it will form about seventy-five per cent of our first effort.

The problem today is one of immediacy with regard to the existing troops that must be brought to a full state of efficiency as quickly as possible. I might remark that we are most fortunate in the character and degree of military planning which has been accomplished. We are also exceedingly fortunate, and it is gratifying and reassuring to report, that we have at the present time a War Department staff composed of a highly educated group of officers who coöperate as a team in a remarkably efficient manner. This is one of the most reassuring and helpful features of the present situation. And along with that comment, it is appropriate for me, I think, to mention, in relation to questions of matériel or munitions—the large proportion of which are critical items of ordnance—that we have in the Ordnance Department one of the most efficient, one of the finest groups of officers in the Army. That is the common opinion of the Army and of every one who has come in contact with the Ordnance Department.

I will not attempt to discuss the problem of industrial preparedness. General Wesson already has commented in some detail on the various factors involved. You have had your meetings since you came here, and you have known, most of you, for years what the great problem has been. You are familiar with the time factor, so it is unnecessary for me to go into that phase of the situation. All of us know that the time factor is the vital consideration—and vital in the correct meaning of the term—of our national-defense program; that we must never be caught in the same situation in which we found ourselves in 1917.

General Harbord, who sits beside me, went to France as Chief of Staff of the American Expeditionary Force—a force devoid of matériel. I sailed with the 1st Division, on the first boat of the first convoy, and I cannot recall a better picture of the vast and terrible problem that General Pershing and his staff had to solve than a description of the conditions under which that expedition left for France. We embarked with part of an entirely new division—I had never even seen a photostat of its organization until I was aboard ship. I then discovered—and I was a member of the general staff of that division—that we had units in the division of which I had never heard. They were on other boats, and because the use of the wireless was forbidden, we could not communicate with them to find out what they were and what they knew about themselves. We studied all the available charts. We sought to familiarize ourselves with the new organization, but there was very little literature on the war as it then was being conducted. We had one small English pamphlet, a single copy, which we studied conscientiously. But our thoughts would always go back to these new units and how they should be employed.

Landing at Saint-Nazaire, I was immediately sent on a circuit of the division as the troops came ashore to find out what they had, what manner of men they were, and what they knew about the organization. I discovered that of the 200 men in each company, approximately 180 were recruits. I found that some of these new units—howitzer companies, groups assigned to handle the Stokes mortars and the 37-mm. cannon—not only did not have the weapons, but the men themselves had never even heard of them. And we were landing on a foreign shore, 3,000 miles from home, to enter the greatest war in history!

I recall the first time the American troops were put into line. They went in by battalions, and it fell to me to make the arrangements. We literally borrowed everything that was loose in France. (Some items we didn't even borrow!) We had no rolling kitchens; we didn't have this, and we didn't have that. I remember that some of the staff from the great GHQ, to which we looked in reverence as to the rising sun and all the powers inherent in it, came down to inspect our departure and were horrified because some of the soldiers had cut the brims off their campaign hats and were wearing the remaining crowns; others wore headgear made from bath towels. Some of them wore the Belgian kepi—probably because it had a gold tassel dangling in front. We went into line in that shape for our first experience—everything begged, borrowed, or stolen—certainly not manufactured in America. That was a trying experience—a complicated affair to manage. Later I became involved in movements of troops up into the hundreds of thousands, but the problem didn't approximate the difficulties of managing that small first group of the 1st Division, of which nothing was normal, except that the men were Americans and were willing to fight.

It has been an inspiration to see a group of gentlemen of your quality of intellect and leadership assembled voluntarily to interest yourselves in the very serious, the difficult, and the really stupendous problem of the industrial program for the support of whatever military and naval effort we may have to make. I feel that it is a reassuring indication of the temper of the businessmen of America. Speaking for the Army I wish to express our appreciation of your patriotism, especially of the continued service you have rendered through the past twenty years.

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EDITOR'S NOTE.—In addition to the above address by General Marshall, readers are referred to other addresses at the Twentieth Annual Meeting of the Army Ordnance Association as published in the last issue of this journal (November-December 1939, Vol. XX, No. 117): "America's Munitions Now," by Brig. Gen. Benedict Crowell, president, Army Ordnance Association (p. 152); "Our Ordnance Heritage," by Maj. Gen. C. M. Wesson, Chief of Ordnance, U. S. Army (p. 153); "Industry Stands at Attention," by Col. Frederick H. Payne, vice-president, Army Ordnance Association (p. 155); "Prepare and Stay Prepared," by Adm. Harold R. Stark, Chief of Naval Operations, U. S. Navy (p. 156).

# A Defensive Military Theory

## *A Critique of Liddell Hart's "The Defense of Britain"*

By Hoffman Nickerson*

BY PERMITTING oneself a little very gentle humor at the expense of a distinguished writer to whom all English-speaking students of war owe a considerable debt, one might imagine Capt. B. H. Liddell Hart enlarging the title of his latest book—"The Defense of Britain" (New York: Random House, $3.50)—so that it read: "Arguments in Favor of a Defensive Theory of War, together with Notes on how I made some Progress in Reforming the British Army."

So mild a jest is by no means intended to disparage the author—far from it. His personal opinions are important because he is a considerable personage. Not only is he a writer and journalist of reputation, but in addition it has been for some time an open secret that he is also a trusted adviser to the energetic Hore Belisha, who is England's present "Secretary of State for War." Consequently, what he says is important both in itself and because it is likely to have real influence on British military policy. None the less, his opinions remain highly personal.

Liddell Hart has blind spots in his mind—which of us has not? Especially when he touches Spain his judgment seems to forsake him, both politically and technically. Politically, in this book he continues to flourish the Hallowe'en pumpkin—an Englishman might write "the turnip ghost"—of a Nationalist Spain dominated by Germany and Italy. During the Spanish Civil War it was repeatedly pointed out that such assumptions argued a total ignorance of the Spanish character with its intense pride and its unshakable love of independence. What a Bolshevik-dominated Spain might have meant to the world in general and to the British Empire in particular we may well ask. Today the neutrality of Spain speaks for itself. On the political side, one might also ask how he would answer the point so often made by Spaniards that British policy requires a weak Spain?

Technically, in his last book—"Europe in Arms"—written not long before the decisive victory of the Spanish Nationalists, the author prophesied that they would exhaust themselves by their own offensive efforts. All commentators, and especially all journalists who must be forever snap-shooting events on the wing, must expect a certain proportion of such misses. That particular miss, however, is important to us at the moment since the book which we are now considering attempts to establish two propositions: the first, that the modern defensive is normally so strong as to make it unprofitable to attack without a three-to-one superiority, and the second—based upon the first—that the British Army should make no attempt to win against Germany by means of land offensives.

To an American reader, the remainder of "The Defense of Britain" is of secondary importance. Its matter is interesting, and the text is written in the clear and lively fashion characteristic of the author. It discusses very sensibly certain aspects of British military policy in the past, argues strongly for young commanders, and makes valuable suggestions, especially as to field training. At the same time, however, it suffers from being a series of selections from papers written by the author in answer to official requests for his opinion. Consequently it often repeats itself. Furthermore, it is concerned with temporary phases of problems more important to Englishmen than to Americans.

TO RETURN to the universal theme of basic military theory: it has always been known that, in general, it is easier to defend than to attack. The great military philosopher Clausewitz, whose sound principles have survived misinterpretation by so many late-nineteenth-century theorists, is emphatic on the point. One of the most familiar of his many true sayings is: "The defensive is the stronger form of war." Like most important truths, this truth has occasionally been questioned. The eminent Prussian theorist Meckel considered a defensive attitude necessarily a sign of moral weakness, going so far as to write: "The resolve to act on the defensive is the first step to irresolution." The still more eminent Von Der Goltz forgot himself when he said: "The idea of the greater strength of the defense is, in spite of all, a mere delusion." Such statements need not detain us. Whatever grains of truth they may contain, as general principles they are demonstrably false. We may banish them to the same limbo to which students of the New Testament long since have banished that curious group of Dutch scholars who contended that no New Testament book except the four major Epistles of Saint Paul had really been written by its traditional author!

The reasons for the greater strength of the defense, in the French phrase, leap to the eyes. The defender can choose his ground and usually can find a position more or less strong by nature. Within the time available to him he also can strengthen that position by the art of fortification. The assailant, on the other hand, must take upon himself the effort and risk of moving forward under fire in order to reach the defender's position. When in motion he must expose himself, while the latter is more or less sheltered, and when in motion he will seldom if ever be able to fire effectively. All told, therefore, a smaller force on the defensive can count on preserving itself from military destruction at the hands of a larger attacking force of approximately equal military quality and armament for a considerable time, and within that time the defenders can inflict heavier losses than they themselves suffer.

Moreover, these immemorial advantages of the defense have been strengthened by modern armament and modern conditions in general. Today, an adequately equipped army delivers fire of such range, accuracy, and volume that the offensive power of the unarmored infantrymen has fallen toward zero. Any number of such assailants are so much

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*Author: "The Inquisition, A Political and Military Study of Its Establishment," 1923; "Warfare" (with Spalding and Wright), 1925; "The Turning Point of the Revolution," 1928; "The American Rich," 1930; "Can We Limit War?" 1934. First Lieutenant, New York National Guard, 1916; Captain, Ordnance Department, U. S. Army, 1917; Duty with General Staff, A.E.F., 1918; Member U. S. Section, Inter-Allied Armistice Commission, Spa, Belgium, 1918-1919.

meat for machine guns. Artillery still retains some offensive power, but the volume of shell fire sufficient to smother a well-prepared defensive is so great as to tear up the whole surface of the ground and thereby check offensive movement. Other things being about equal, it remains to be seen to what extent an assailant provided with tanks, airplanes, and artillery can penetrate the defended front of an opponent who has a fair number of antitank and antiaircraft guns as well as tanks and planes of his own for counterattack. Such an enterprise does not seem easy.

While modern fire power makes a defender's front difficult to break, other modern conditions make his flanks difficult and sometimes impossible to turn. The numerous populations and high total wealth of the world, the development of modern transportation by land and sea, and especially the nation worship which gives modern governments an unprecedented control over the bodies and purses of their subjects, all combine to permit the raising of enormous armies. In the west of Europe, these armies, as we all know, can spread themselves across whole theaters of war, extending their flanks until those flanks rest upon neutral boundaries or upon natural obstacles such as the sea. Today, on the Western Front, it is as if two hostile groups met head-on in a narrow corridor. Finally, modern constructive power permits the erection of vast fortified systems like the Maginot and Siegfried Lines.

So far so good: the defense always has been the stronger form of war and has proved itself peculiarly strong in our own time. This, however, is not the end of the argument but only the beginning of it.

FROM the truths just cited, Liddell Hart advances into more doubtful ground. Several times he repeats that today a successful offensive demands a three-to-one superiority in matériel. The strength of contemporary armies should, indeed, be reckoned more in terms of fire power, together with skill and training in the use of complex weapons, rather than in terms of brute man power; but to lay down the necessity for a three-to-one superiority as a rule of thumb is another matter. When our author says that in Spain the victorious Nationalists enjoyed such a superiority, one is uncomfortably reminded of his error during the Civil War there when he said that they were exhausting themselves by attacking.

One can easily think of probable military situations in which a three-to-one superiority would not suffice and of others in which a lesser superiority would be enough. The Allies of 1918 had no such superiority when they compelled the Germans to armistice terms so severe as to amount to a capitulation. Further, bold, clever, and fortunate leaders in the past often have produced a local superiority out of a general inferiority by means of maneuver. Without going back to Napoleon in 1796, to Jackson in the Valley of Virginia, or to Von Moltke in 1866, the Germans did something of the sort in September 1939. At the opening of the campaign they certainly had no three-to-one superiority in weapon power over the British-French-Polish combination as a whole. They actually may have been inferior. They certainly had fewer trained men. Nevertheless, the rapid and locally decisive success of their Polish campaign is already history. In short, the attempt to lay down any rule of thumb for the endlessly varying circumstances of war necessarily lends itself to endless discussion.

Nor is it easy to find instances which would make such discussion intelligent. Since 1918, the tides of military change have run strongly. If we leave permanent or at least previously prepared fortification out of account, then defensive power seems, if anything, to have ebbed in the interval because of the increased strength of air forces and mechanized ground arms. When the great Vauban said that an army of over twenty thousand could besiege a garrison one-sixth as strong as itself but that ten thousand men might not be able to besiege a thousand, he was at least generalizing from a number of examples. But from what examples can an analyst of war today deduce even approximate mathematical proportions of this sort? Neither the Russo-Polish War of 1919-1920, nor the Japanese campaigns on the Asiatic mainland, nor the Italian conquest of Ethiopia, however fertile in military lessons, closely resembles what seems likely to happen in Central and Western Europe. The Spanish Civil War obviously differed from a national war between great powers. Moreover, that struggle is still imperfectly known. Who, for instance, can say how such factors like better organization and leadership, which have nothing to do with matériel, contributed to the Nationalist victory over the Reds there?

ALL told, therefore, if we consider the defensive theory merely as a general principle, we seem forced to conclude, with all possible respect to Liddell Hart, that he has ridden his idea a little too hard. Clausewitz in the same breath as that in which he acknowledged the greater strength of the defensive went on to say that this form of war is essentially negative. The reflective Prussian continued: "Whoever feels himself strong enough to make use of the weaker form, that is of the offensive, can aim at a greater object." If your enemy attacks you, then the defensive may well enable you to achieve the positive result of inflicting upon him losses heavier than those which you yourself suffer, but if he will not oblige you by attacking, then you must either attack him or do nothing. When a certain highly intelligent British officer was privately asked what he thought of the defensive theory he is said to have replied: "You can't say that one form of war in itself is more worth adopting than the other. Both offensive and defensive are only tools in your tool bag. The choice between them depends on what you are trying to do."

This brings us to the concrete case to which our author intended his defensive theory to apply; that is, to the military policy or grand strategy of England in the case of a war waged in alliance with France against Germany. Here pure theory, although still remaining extremely important, must adapt itself to the circumstances peculiar to the case in question. In other words, pure strategy in practice must always become national strategy.

Our author has long contended that in 1914-1918 British grand strategy was faulty in that a large army was raised, sent to France, and frequently used for offensive action there. At every point, according to him, British action on land was unwisely subordinated to that of the French. The traditional British policy of fighting chiefly with warships, money, and the blood of her Continental allies, meanwhile directly supporting those allies only with a small expeditionary force, was abandoned. The effects of that abandonment—the loss of so many British lives, and the expending of so much British wealth—have been disastrous. It would therefore be better for the island kingdom to act after a fashion more like

that which so successfully served her interests in the past.

This contention Liddell Hart has accompanied with abundant criticism of French generalship, particularly with regard to Joffre and Foch, and he has extended his strong disapproval to British generalship on the Western Front—in other words, to Haig. In these matters, much of what he has said is demonstrably true and needed saying badly. At the same time we must remember, in connection with what he now says, that in the past his estimates have not always seemed to allow sufficiently for the difficulties of a commander in chief in the field. One remembers Joffre's bitter saying: "I don't know who won the Battle of the Marne but I well know who would have been blamed for losing it if it had been lost." As to Haig, his warmest defenders have not claimed that he was especially brilliant, and in 1917 his choice of Passchendaele as an offensive sector resulted disastrously. Even there, however, the stubborn Scotchman's persistence gave enormous aid and comfort to the hard-pressed French whose army was threatening to dissolve in a wave of mutinies which have been most carefully hushed up to this day.

IN FURTHER advocacy of a return to England's traditional military policy, the present book introduces a second line of argument based upon the change in the strategic position of the island kingdom on account of the submarine and the airplane. Before these new weapons existed, a surface fleet was almost invincible when out of gunshot of land, and the possession of a superior fleet, supported by flotillas of light craft for convoying merchantmen which might be threatened by hostile surface raiders, gave complete security. Today, both submarines and airplanes greatly increase the possibilities of guerrilla warfare against the merchant ships which bring the food needed to support the population of Britain. In 1917, the few German submarines available, favored by the unwise policy of the British Admiralty, nearly won the war. Further, airplanes can strike at the center of a country and could certainly do much damage. Although no one knows how effective they might be, in the absence of a considerable defensive effort they might conceivably compel a national surrender after the fashion imagined by the Italian, General Douhet. Such efforts absorb both man power and money, and the same is true of the numerous light craft, the armament of merchant ships, and the other measures needed to combat the submarine menace.

If airplanes or submarines, or both together, could compel a British national surrender before a final decision had been reached on land, then no partial Franco-British land victories, however brilliant, could affect the result. Consequently, antisubmarine and antiaircraft defense are first charges against England's war effort, just as a surface fleet of the old type always was and still is a first charge. Some two years ago, at the instance of Liddell Hart, Hore Belisha went so far as to say that antiaircraft defense was the first duty of the British Army. At all events the peculiar vulnerability of the island to the new weapons imposes a corresponding defensive effort which diminishes the resources that would otherwise be available for organizing a mass army capable of offensive action.

Like the argument from the admittedly disastrous results of 1914 even to the victors, so this second argument from the new weapons is undeniably sound as far as it goes. On the other hand, the new weapons, like all forms of armed effort, must operate from land bases and are effective in proportion to the distance between those bases and the objectives which are to be struck. If an enemy can halve the distance between his objectives and his air or submarine bases by advancing the bases, then the effectiveness of his effort will at least be doubled. In practice, it probably will be much more than doubled. If, on the contrary, you can push back the enemy's bases, then his power to harm you will be correspondingly diminished. Now it remains as true today as it was at the beginning of human record that only land forces can occupy territory. In the particular situation of England, not only the northern French coastal regions but also Belgium and Holland are vital to her. How far her air force alone might help to prevent a German occupation of these territories no one can say, but it is at least arguable that it would be in the interest of her own defense against airplanes and submarines to have a ground army capable of rendering a generous share of aid in directly defending France, Belgium, or Holland, or all of them. That would mean a powerful army of some size.

CONTINUING our summary of the author's thesis: To the arguments drawn from England's exhaustion after 1918 and from her peculiar vulnerability to the new weapons he adds a third argument against the raising of a large British army intended for offensive action on the Continent. The mass army, so he contends, has lost its value because of the decline in the offensive power of infantry and because of its vulnerability to air attack. In the past, he has gone so far as to say that such armies, together with their necessarily crowded communications, would offer so perfect a series of targets to hostile air raiders that they would be positive detriments to the nations which might attempt to use them. According to this idea, a nation would make itself formidable in proportion as it diminished its army and increased its air force—perhaps supporting the latter with a few mechanized divisions. In the present book he does not return to this extreme position; nevertheless signs of the same tendency can be found therein.

What, then, are we to think of this third argument from the declining efficiency of mass armies? Up to a point, its reasoning is correct. In the nature of things, mass armies must be composed, in great part, of infantry; no other arm could possibly be multiplied by the million. Moreover, since 1914, foot soldiers have undoubtedly diminished in value; today their most enthusiastic admirer could not claim that they have the same importance relative to the other arms which they had twenty-five years ago. Indeed, if we define the term infantry strictly as "footmen armed with weapons, each of which can be both carried and operated by a single man," then there are few unmixed bodies of them left. What with antitank guns, trench mortars, heavy machine guns, etc., a considerable proportion of most units which today call themselves infantry are really light artillery.

Here, however, agreement ceases, for competent judges differ enormously as to how far the decline of infantry, and therefore of mass armies, has gone. Even if English authorities were unanimous in believing that decline to have gone very far, still those authorities would have to reckon with the opinion of their allies. Since as yet no Continental nation has willingly disbanded its mass army, it would have been difficult to convince anyone outside England of the sincerity and determination of British purpose unless the island was at least moving toward the creation of such an army. In practice, the desire to reassure seems to have been important. We may be morally certain that last May when England—against the protest of Liddell Hart—instituted conscription, one reason

for so sweeping a change was the pressure of her allies.

Having mentioned in turn the main points made by the book in favor of a defensive policy for the British Army, we may conclude by setting down very briefly certain impressions provoked by its thesis as a whole.

THE first of these impressions is a doubt whether it is wise in a Secretary of War to take for an adviser a distinguished journalist in active practice. Further, it would seem even more doubtful whether the memoranda of such an adviser should be published in detail. Were it not for the obvious good faith of the author and the force of his reasoning one might be tempted to believe that these memoranda may have been published as a blind.

A second impression is one of the extreme difficulty of England's military problem. Perhaps that problem has become insoluble. Considering strategy alone, one might argue that the island kingdom, irrespective of the outcome of the present war, cannot long remain a great power. Here is a vast oceanic empire, its parts scattered all over the earth, inhabited by most varied peoples, and held together only by supremacy at sea. Suddenly, within the lifetime of all mature people, the insular heart of that empire, formerly invulnerable, has been laid open to air and submarine attack, while new and formidable sea powers—Japan and Italy—have arisen.

Imagine a man sitting at a table and playing a game against, say, three children, the game consisting of trying to hold down with his fingers some twenty checkermen on the table. Obviously, piece after piece must be snatched from him —he has not fingers enough to go around! Meanwhile the process will be speeded up if one child occasionally hits him a playful blow on the head with a sofa cushion. The man is England; the three children, Germany, Italy, and Japan; the game is in deadly earnest, and on the face of the matter its outcome seems certain. The children may not be coöperating; each may be snatching wholly for its own hand, still the result will be much the same: the man must lose many pieces. As an intelligent Englishman put it to the writer of these lines last summer when the Japanese were publicly stripping Englishmen and Englishwomen: "Japan has us by the tail in the Far East because Mussolini has us by the throat in the Mediterranean." At that moment the third child in the imaginary game, Germany, had not yet brought the sofa cushion into play. On the other hand, well-wishers of England may console themselves with the famous Irish bull: "Nothing is inevitable until after it has happened."

Inevitably, however, as one closes "The Defense of Britain" one wonders again, as all the world is doing, over the outcome of the present war. The ideas of the book affect that outcome closely. Even though England is for the moment tied to French strategy on land, and even though she herself has adopted conscription, still the slowness with which she is increasing her military numbers and her obvious lack of haste to improvise an army on the Continental scale are directly in line with the thesis which this article has been considering. The United Press dispatch from London which, in the New York dailies of November 17th, reported the Anglo-French economic accords, included the following observation: "French circles here were cheered by tonight's report, pointing out that France has mobilized one out of every eight men of military age as compared to Britain's mobilization of only one out of forty-five." Without considering the wisdom or unwisdom of publishing such figures, their meaning is clear: be the offensive spirit of England's leaders never so high, they will long be unable to launch any great land attack. Except for the possibilities of air warfare, England's chief offensive weapon must long remain the blockade. For the moment, a policy like that advocated by Liddell Hart has the cry.

Now blockade is an offensive weapon, let us make no mistake about that. In his famous analysis of objectives in war, Clausewitz listed "the seizing of an enemy's resources" next after "the destruction of his armed forces" and ahead of "the gaining of opinion." A successful blockade effectively seizes his resources.

ON the other hand, a blockade acts slowly. Since it produces few exciting or dramatic instances it is uninspiring, and there is not much comfort in saying: "We are indeed having a bad time but surely the enemy is worse off." Further, you seldom can tell how great the enemy's hardships are and how well his morale is standing the strain. In the present instance, each side is trying to blockade the other. All this, in addition to the enormous discomforts and sacrifices imposed upon everyone by the vast scale of modern war even when that war is causing few casualties, results in a severe moral strain.

How long the people of the different fighting countries might endure such a strain we do not know. In the last war the Germans withstood it until they lost hope of a decisive victory by their armies in France. Nor can anyone tell whether the present blockade will succeed in making them as uncomfortable as they then were. Meanwhile the British and French will not be altogether comfortable on their side. The Germans are already trying hard to detach France from England, or at least to cool French enthusiasm for the war, and in this the British policy of not raising a great army might come to their aid. In connection with the striking figures of the proportion of valid men now mobilized in the two allied countries, one remembers a scurrilous joke current in 1915 to the effect that Germany would fight to the last German and England would fight to the last Frenchman.

Now the French have a highly developed critical sense. Their politicians have less hold upon them than English governments have upon their people because in France parliamentary politics is a despised trade plied almost entirely by nonentities who are often detested with a ferocity seldom seen on the other side of the Channel. Take, for instance, Monsieur Daladier. He is nobody in particular. He fought well in the last war and was several times wounded, but this, in France, is far from exceptional. Like all French Parliamentarians he has risen by his talent for personal intrigue, and he happens to be the Minister who, on February 6, 1934, ordered the troops to fire upon a crowd of unarmed war veterans, many of whom had been severely wounded in 1914-1918. In short, the English must reckon with French general opinion far more than would be the case if the French had a form of government more revered by that people at large.

Of course if the Germans attacked and were repulsed with losses to themselves far heavier than the losses they inflicted on the French and British, then, as Liddell Hart truly says, the morale of the unsuccessful assailants would fall while that of the successful defenders would rise. There are, however, other possibilities which he does not mention. For instance, the Germans might gain a certain measure of success even though they fell short of decisive victory. Then what? This is a question which neither "The Defense of Britain" nor events up to this writing have attempted to answer.

# Naval Ordnance

## *Procurement from Government and Private Sources*

By Rear Adm. W. R. Furlong*

THE procurement of naval ordnance is of particular interest at this time to Army and Navy Ordnance and procurement officers, to the manufacturers of ordnance, and to the appropriation committees of Congress. I will endeavor to treat the subject so as to bring out some of the policies underlying Government procurement which are of concern to all persons interested in the conduct of the public's business.

The Navy is now carrying out the largest peace-time shipbuilding program in its history, except for the year following the Armistice when construction begun during the World War was being completed. In this fiscal year of 1940, construction will be continued and equipment completed on 121 vessels started previously, and design and construction will begin on 23 more vessels, making a total of 144 new vessels for the Navy. This unprecedented peace-time building has required extensive expansion in the shipyards and in the mills and factories producing the various classes of materials that go into naval vessels.

NEW SHIPS COMMISSIONED IN EACH ADMINISTRATION FOLLOWING THE WASHINGTON CONFERENCE OF 1922

| *Ships Commissioned* | *Harding and Coolidge (Washington Conference 1922 to March 1925)* | *Coolidge (March 1925 to March 1929)* | *Hoover (March 1929 to March 1933)* | *Roosevelt (Mar. 1933 to Jan. 1937)* | *Roosevelt (Jan. 1937 to July 1939)* |
|---|---|---|---|---|---|
| Battleships | 2 | .. | .. | .. | .. |
| Heavy Cruisers | .. | .. | 10 | 6 | 2 |
| Light Cruisers | 10 | .. | .. | .. | 7 |
| Aircraft Carriers | .. | 2 | .. | 1 | 2 |
| Destroyers (1850 tons) | .. | .. | .. | 7 | 6 |
| Destroyers (1500 tons) | .. | .. | .. | 17 | 23 |
| Gunboats | .. | .. | .. | 2 | .. |
| Submarines | 32 | 6 | 3 | 8 | 14 |
| TOTALS | 44 | 8 | 13 | 41 | 54 |

The procurement of ordnance for these vessels has necessitated some heroic measures to prevent the manufacture of ordnance from being the bottle neck in the whole construction program. This program includes every type of ship—battleships, cruisers, aircraft carriers, destroyers, submarines, mine layers, repair ships, tankers—and the various types of airplanes. In all these types there is a wide variation in the ordnance required. The Bureau of Ordnance of the Navy is responsible for the procurement of the armor, armament, and ammunition for all of these types.

There is a different and more difficult procurement problem in this accelerated program than in war-time procurement. In the last war, the problem was to manufacture in great quantity guns and ammunition of proved and tried design. There was no time to delay the installation of a ship's battery while a new type of gun was being developed. In this peace-time program, although the greatest speed possible is being made, the Bureau of Ordnance is at the same time designing and building to new designs of 16-inch guns for the battleships, new designs of antiaircraft guns, and new designs of projectiles, torpedoes and bombs. Since no heavy armor has been made for battleships since 1922, extensive experiments and tests have been and are being conducted by the Bureau of Ordnance and by the steel mills to acquire again the technique of heavy-armor manufacture.

All this new design and development has to be done, not in the tempo or atmosphere of normal peace-time procurement—far from it. I do not have to dwell upon the extremely difficult international situations with which the President has been confronted. We all have watched those situations build up in Europe, Africa, and Asia—situations that were so close to our interests as to require us to be strong. Strength was needed immediately—at the moment—as is usual in international situations. But we had not kept our Navy built up since the Washington Disarmament Conference of 1922. No ship was authorized during the Hoover administration, but ships previously authorized were appropriated for and added to the fleet as shown in the table on this page. Now we are confronted with building up the fleet at a greatly accelerated pace, and ordnance procurement must be rushed to meet the building program.

TO meet this demand for ordnance there are two sources of procurement—Government plants and private plants. The Bureau of Ordnance of the Navy operates 24 Government ordnance stations (only 4 of which are engaged in manufacturing, the others being assembly plants) and in the fiscal year just closed, the Bureau procured ordnance from 292 private contractors.

The large Naval Gun Factory at Washington, D. C., though speeded up and employing as many men as our largest navy yards, is not able to meet on time the ordnance requirements of the shipbuilders in this program. To assist in meeting these requirements the Bureau of Ordnance of the Navy has called upon the Ordnance Department of the Army. The Chief of Ordnance of the Army, Maj. Gen. C. M. Wesson, under whom the arsenals operate, has been most helpful and coöperative. The arsenals have been turning out work for the Navy for four years, averaging about $5,000,000 annually, and they will have work in excess of $6,000,000 for 1940 supplying the following: projectiles and fuzes, from the Frankford Arsenal; secondary-battery equipment, from the Rock Island Arsenal; gun mounts, from Watertown, and some major-caliber and secondary-battery guns, from Watervliet.

This is a very fitting place to acknowledge the excellent working arrangement between the Navy Bureau of Ordnance and the Army Ordnance Department. The coöperation between the Army and Navy ordnance designers and production personnel is something of which to be proud. It is as close and direct as the coöperation between the bureaus within the Navy itself. It is a great object lesson against any arguments for a unified national-defense department.

*Chief, Bureau of Ordnance, Navy Department.

The Government plants under the Bureau of Ordnance of the Navy are the Washington gun factory; the torpedo stations at Newport, R. I., Keyport, Wash., and Alexandria, Va.; the powder factory at Indian Head, Md.; the ordnance plant at Baldwin, L. I.—for loading illuminating projectiles and parachute flares; the naval proving ground at Dahlgren, Va.—for testing armor, projectiles, and bombs, and proving every gun and index of powder that goes into a ship; the mine depots at Yorktown, Va., and at New London, Conn.; the ordnance plant at Charleston, W. Va., now partially operative, and fifteen ammunition depots and magazines for assembling and delivering ammunition to ships. The personnel of all these plants, together with the officers and civilian inspection force in private plants and the 240 officers, engineers, and clerks in the Bureau of Ordnance, comprise a total of 14,000 employees.

DURING hearings before congressional committees the Senators and Representatives showed the keenest interest in the question of Government manufacture vs. private manufacture. Some loafing has been observed at navy yards. A very few politicians attempt to interfere with the administration of Government plants, particularly when the discharge of a Government employee is involved. These occurrences lead to the conviction by some persons that Government-operated plants are expensive and that it might be better to have all procurement from private industry.

But there is justification for some Government manufacture and for the permanent establishment of some Government plants. This was evident when this naval expansion program began. For example, the Bureau of Ordnance desired to procure the large steel castings through which the 16-inch guns slide as they recoil on firing. A dozen private companies that make steel castings were canvassed and asked to bid on these slides, but only one company would take the risk of rejected castings, and that company would take only seven of the fifty-four castings desired. Fortunately, the gun factory at Washington had been making steel castings for years; however, several months' time was necessary to construct a much larger pit in the foundry floor at the gun factory, to take castings weighing 100,000 pounds each. But for the existence of these Government facilities, the large gun slides could not be ready for the shipbuilders in time, and the completion of the ships would be greatly delayed.

Another example of the advantage of having a Government plant fully equipped and ready to expand is seen in the Government manufacture of guns for the present shipbuilding program.

After 1922, the date of the Washington Disarmament Conference, the two steel companies—Bethlehem and Midvale—equipped at that time for making major-caliber guns, manufactured no more guns of the two largest calibers, and one of the companies turned its space and equipment to commercial manufacture. A survey of these plants shows that considerable time and expense would be required to place them again in condition to manufacture large-caliber guns. Fortunately, there exist capacity and skilled mechanics at the Naval Gun Factory at Washington, which, supplemented by the Army's Watervliet Arsenal, will be able to meet the present emergency and finish the batteries in time. This is a case wherein the needs of the nation are met through capacity and skilled mechanics in Government plants. No commercial plant wishes to maintain a great amount of machinery used only occasionally for large guns, or to maintain buildings on which there are taxes and depreciation but no profits.

It is sometimes difficult to measure the value of a Government plant to the nation. This is brought to light yearly when members of a congressional committee question the Chief of the Bureau of Ordnance on the value of the ordnance plant at Charleston, W. Va. This plant, with a $25,000,000 outlay, began production in September 1918 and was closed in February 1922. But the mere building of the plant had a moderating influence on the prices the Government paid private firms for projectiles, armor, and gun forgings, which, at the time, were thought to be exorbitant. During the present need for steel to meet an accelerated building program, the capacity of the United States steel plants is not sufficient to meet delivery dates for a particular kind of armor. To meet these dates, the furnaces of the Charleston plant have been put to use to augment the capacities of private plants. When a nation is in a hurry—and the international situation might require a very great hurry—this extra capacity in a dormant Government plant suddenly assumes a value that is difficult to evaluate. For the last two years, some patriotic Americans, with an eye to personal profit, have kept continuous pressure on the Bureau of Ordnance to sell the equipment of the Charleston plant to them for a song in order that they might sell it to a foreign country at a good profit. It is now of value to the United States in solving its own problems of procurement.

A Government plant, such as the Naval Gun Factory or an Army arsenal, with competent design and drafting force, can produce certain equipment in emergency in less time than it can be procured from private industry. To procure the turret and equipment for the secondary battery and for the antiaircraft guns for the new battleships from a private manufacturer, all the drawings to the last detailed piece must be completed in order to obtain bids from a number of companies and in order to draw up a contract. Without the complete drawings the companies could not estimate on the price. It has taken a year to make the general arrangement drawings for these turrets and their equipment, and it will take another year to complete the detailed drawings for manufacture of the various parts. These would have to be completed before placing a contract with a private company. But in procuring from a Government plant, as soon as some of the drawings are finished they may be sent directly into the shops and manufacture begins while the rest of the drawings are being finished, to be sent to the shops later. That is being done right now both at the Naval Gun Factory and at Rock Island Arsenal because there would be no hope of meeting the dates desired if the usual methods were followed of completing all drawings and sending out for bids.

IT so happens that gun design, particularly for the major-caliber guns, is best done by Government designers. Private companies cannot afford to maintain a staff of gun designers because there is little continuous demand for their work. But the Bureau of Ordnance has its own gun designers, who, with a knowledge of practical requirements in the Naval Gun Factory and with the information from proving-ground tests, are capable of designing a gun. The rough steel forgings from which the gun parts are machined are procured from private steel companies. A half dozen or more of these forgings are required to make a large gun. But the gun is produced only from most careful design experience accumu-

lated through the years from gun failures and successes. The advantage to this Government of having only Government designers of naval guns was brought to light by recent urgent requests from several foreign governments to obtain the designs of our latest antiaircraft guns and our large 16-inch gun. Had we been making these guns in private plants it would not have been difficult for unauthorized persons to obtain the designs. But with the designs in our own Bureau it is hoped that they have been kept confidential.

There are only three or four American exporters who give the Bureau trouble by trying to peddle the Government's latest developments abroad, thus necessitating annoying precautions on the part of the great number of reputable manufacturers who coöperate fully in an effort to maintain secrecy.

INFORMATION regarding naval ordnance is kept secret by stipulation to that effect in the contract, as required by the Neutrality Act of 1935 (amended in 1937). Exporters of arms and ammunition must obtain a license for export of ordnance, and the Espionage Act also may be invoked. Secrecy about such guns as are made only in Government plants is maintained by the act of July 1, 1918 (U.S.C. Sec. 638), which prevents furnishing Navy-built guns to foreign countries. The law states: "No money appropriated for ordnance . . . for the Navy shall be used for any other purpose than that for which the appropriation was made." This law helps greatly in maintaining secrecy and saves our Government many embarrassing situations when it is importuned by foreign friends—and possible enemies—to release designs or to export ordnance made in our Government plants. The Espionage Act operates, too, on our own Government officers as well as on private individuals by providing imprisonment for not more than twenty years for delivering to a foreign government any sketch or document relating to the national defense that is to be used to the injury of the United States or to the advantage of a foreign nation. A bill was introduced in the last Congress to make possible the supply of Government-manufactured armament to foreign nations but the bill was defeated.

In Government manufacture, the cost to the Government is increased by reason of each employee being paid for one month's work when on leave, and paid for as much as one month more for sick leave, if actually ill. Employees average about five or six days' sick leave per year with pay. There is abuse of this in some Government plants as records show sick leave to occur more frequently on days next before or next after holidays. Costs are further increased because the employees, through long tenure in Government employ, get into the higher brackets of pay in Government plants in greater proportion than in private plants. On the other hand, the Government shop employee is likely to be a better mechanic because he is in more continuous employment and is not furloughed when orders cease.

Many object to Government competition with private industry, pointing out that the Government plant does not have to pay taxes or insurance. The Government plant, though it may pay more to labor, does not pay as high salaries and bonuses to executives, nor is it under the necessity of paying profits to stockholders. On the whole, if the Government plant is operated with efficiency, in spite of its higher costs for buildings and labor, it should produce articles cheaper than private industry because of the extra costs that private industry must meet.

A great quantity of ordnance material is produced by the same type of shop equipment and machine tools used in the manufacture of commercial articles. It is for such material that the Bureau of Ordnance gives all business possible to private plants. For example, a firm that makes large printing presses, which are heavy structures requiring accuracy of operation, also can make gun mounts with accurate gears for elevation and train. A firm that makes safes and special burglarproof steel also can make bulletproof steel. The firms that make watches can and do turn to making the mechanical time fuzes used in thousands of antiaircraft shells.

THE Bureau encourages as many manufacturers as possible to enter the field of ordnance in order to secure for the Government the inventive genius of numerous engineers working to improve the product. The competition in brains that comes from the employment of private industry has been one of the most important factors in our advance in fire control. There are three private plants with excellent design engineers and with considerable capacity and room for expansion whose entire output is devoted to Navy fire-control apparatus. Other plants also produce fire-control equipment, but the Navy is not their sole customer. The obvious reason for procurement from many private firms is to provide means for great expansion in time of war. In time of peace, the Bureau of Ordnance, as a matter of economy, encourages all reputable and properly equipped manufacturers to compete for Government business. The contract award is to the lowest bidder. A comparison of the amount of private manufacture with Government manufacture may be seen from the following expenditures by the Bureau of Ordnance:

| *Fiscal Year* | *Private Plants* | *Government Plants* |
|---|---|---|
| 1936 | $25,549,954.47 | $28,246,044.48 |
| 1937 | 23,231,229.42 | 38,913,907.42 |
| 1938 | 31,100,532.82 | 36,735,460.82 |
| 1939 (first 10 months) | 41,136,297.07 | 34,575,448.84 |
| 1940 (estimated) | 50,000,000.00 | 42,000,000.00 |

In the above table, a great portion of the expenditures listed for manufacture in Government plants includes purchases from private industry of raw materials and unassembled equipment. At such Government plants as the gun factory, the powder factory, and the torpedo factory, all raw materials, chemicals, castings, forgings, optical instruments, tools, motors, etc., are purchased from private plants.

The Bureau of Ordnance believes in the use of private industry whenever it can be done. In fact, for the greater part of its requirements the Navy is dependent upon private industry and works closely with the scientists and engineers of several hundred private plants in producing naval ordnance.

During the present building program, a great number of new companies that were not in the ordnance field before have entered it. Formerly, production of ordnance was confined to the states of the Atlantic seaboard. Now we can obtain oil motors for elevation and train of guns from Detroit and Minneapolis; formerly they came only from Connecticut. Tennessee has taken an order for $689,000 worth of brass cartridge cases in competition with eastern firms. A factory in Los Angeles produces an excellent quality of cartridge-case tanks, recently obtaining an order amounting to about $900,000 in competition with the factories of the East. And in the eastern states, many new companies are producing equipment.

NAVAL ordnance must be made to exact size. Above all, it must be safe for those who use it and must produce the desired effect in action. The computing instruments must be accurate; there must be no duds in fuzes or shells. To obtain this high quality, the Navy demands that material must be produced by manufacturing companies possessed of high-grade and precise machine tools manned by skilled mechanics. To be placed on the list of manufacturers who are asked to bid on ordnance material, a company must receive a favorable report from the Bureau of Ordnance inspector on the ability of the plant to produce the articles. The plant must be efficient and reputable and have financial standing in order not to fail in the middle of a contract and embarrass the Government by nondelivery of materials urgently needed to complete a ship or its equipment.

When a naval ship is appropriated for and its keel is laid, the materials must be produced for it in time of peace; equipment must be accurate and precise; its ammunition and a portion of reserve ammunition are provided for it, and all of this must be of the best workmanship and must be completed in time. It will thus be seen that there is no place for so-called "educational orders" in naval procurement. With the Army, I am told, the situation is different because the authorities expect to procure in great quantity after an emergency arises, while in equipping a navy there is not such great war-time expansion. In proportion to Army procurement, more is procured in peace time, when the guns are built into the ship.

In the present accelerated shipbuilding program armor threatened to be the bottle neck. Some light armor is required in the cruisers and aircraft carriers. This is not a difficult problem, but to add to it the manufacture of heavy armor for the eight battleships now under construction is to tax the capacities of the steel mills and the Naval Proving Ground to the limit. Few realize that in the delivery of armor to the shipbuilder, one plate out of every small group of seven or eight plates must be fired at and accepted at the proving ground before the armor can be delivered. The shells, powder, and every gun sent aboard ship must first be proved at our ridiculously small and underofficered proving ground.

Only three companies make armor—the Carnegie-Illinois Steel Company at Munhall, Pa.; the Midvale Company at Nicetown, Pa., and the Bethlehem Steel Company at Bethlehem, Pa. Other companies make other types of steel that go into ships, but only these three make the armor. They have been making some light armor for cruisers but had made no heavy armor for battleships for sixteen years. Naturally, some extraordinary measures have been taken by the Bureau of Ordnance and by these steel companies to enable them to produce armor on time. Not only are the physical equipment and the machines involved, but the technique of armor-plate manufacture itself must be regained.

The demands upon the armor plants were greater than their normal capacities could possibly meet. Yet the President needs and wants ships not only in the usual building time but in shorter time than they have been built before. The steel companies were reluctant to replace their worn-out equipment and were opposed to extending their facilities for what might be short-lived business. Their reluctance to expand to meet this emergency arose from the manner in which the Vinson-Trammell Act was administered.

This act is of primary importance in procurement of material for the Navy. The act is more important than either industry or the personnel in government seem to realize today. It is important to every citizen because it is the beginning of limitation of profit on business with the Government. As the idea in the act is expanded in future legislation it will have a far-reaching effect on all Government procurement. The original Vinson-Trammell Act of 1934 applies only to procurement of naval ships and naval planes. It provides that the contractor "pay into the Treasury profit in excess of ten per cent of the total contract price . . . for the construction . . . or manufacture of any complete naval vessel or aircraft or any portion thereof."

The act as amended in 1936 allowed the contractor, in case of a net loss on contracts completed in one year, to credit that loss to the next succeeding income-taxable year in determining excess profits. This amendment exempted entirely from profit limitation "scientific equipment used for communication, target detection, navigation and fire control as may be so designated by the Secretary of the Navy." This exempts such equipment as range finders, computers, and bomb sights.

WHEN Congress, in 1939, provided for the expansion and purchase of Army aircraft, the provisions of the Vinson-Trammell Act, under which the Navy has been operating for five years, were made applicable to procurement of these aircraft, but the profit limitation for airplanes was raised from ten per cent to twelve per cent, and the credit for losses on completed contracts for airplanes was extended to the next succeeding four years. This increase of the limitation of profit to twelve per cent and the extension to a total of five years for offsetting excess profits by losses, if any, were in the same act applied to procurement of naval airplanes. However, the limitation of profits on ships remains at ten per cent with two years to offset excess profits by losses.

The law, so far as return of profits to the Treasury is concerned, is not yet in full swing as regards Army airplanes, but under its operation for Navy procurement some money has been found due the Treasury. The amount due in excess of 10 per cent profit last year was $2,147,000. This amount is computed from statements submitted by the contractors on 116 contracts. There was a total of 343 contracts valued at $45,000,000 to which the act was applicable, and the contractors reported, besides the above excess profits, losses of $2,404,000 on 133 contracts. This was before the Treasury Department had reviewed the reports. There is a vast amount of Navy purchasing to which the law does not apply as it is applicable only to the construction of a complete new ship or airplane or any part thereof and not to the many contracts necessary for the supply, repair, and maintenance of the fleet. It was applied to construction of ships for the United States merchant marine in 1936.

There are now pending in Congress bills to liberalize the law further by providing that if there is a net loss or a net profit less than ten per cent on contracts for a complete naval vessel, such net loss or deficiency in profit shall be allowed as a credit in determining excess profit during the next succeeding four income-taxable years. Provision in the bills also is made, in the case of the twelve per cent profit limitation on airplanes, to credit a loss, deficiency, or profit during the next succeeding four income-taxable years. Under these circumstances, the argument for giving the higher profit to the so-called infant airplane industry will not be thought so necessary in many quarters, and the next legislation probably will be toward limiting airplane contractors to the same ten per cent profit as ship contractors.

When there is keen competition there is not the need for limitation on profits. However, a few companies are the sole producers of certain equipment and have no competition and no limitation of profit, and where there is competition some returns have been due the Treasury in excess of ten per cent. The idea is not for the Government to make money but to receive a fair price.

WHEN it became evident that there was necessity for considerable expansion in the steel mills involving rather large costs for new equipment, the Bureau of Ordnance learned that the method of allowing for these costs, as currently carried out by Treasury regulations, was not satisfactory to the steel companies; that the steel companies were reluctant to buy new equipment or make the necessary plant expansion, and that therefore the shipbuilding program proposed by the President would not be carried out.

The Treasury, in allowing costs for equipment, normally requires the companies to spread their costs of new equipment over ten to twenty years or whatever is considered to be the useful life of the particular piece of equipment. This is not satisfactory to a company where the equipment and tools are purchased solely for use on the one Government contract in hand with no assurance that another contract will follow.

Two battleships of the 1937 program were being built in 1938 when the President proposed four more battleships to be started in 1938, followed by two more in July 1939. It was very plain that something had to be done to expand plant facilities for armor making. One hundred and thirteen naval vessels of other types were building at the same time. The reluctance of the companies to expand facilities or to promise the delivery dates desired on battleship armor arose from the considerable monetary outlay involved, running from a half million to a million dollars in each of the three steel companies. It was evident that there could be no accelerated shipbuilding program. The Chief of the Bureau of Ordnance therefore proposed on April 13, 1938, in a letter to the Secretary of the Navy, that our inspectors in manufacturing establishments should certify as to new equipment installed and plant extensions made solely for the purpose of a Government contract and that, where this was established and certified by the Navy to the Treasury Department, the cost of the new equipment and extension of facilities should be allowed in reckoning the limitation of profit made on that contract. If another contract were placed before the first one was finished, the whole cost would not be chargeable to the first contract but would be spread over the next or succeeding contracts. The Navy Department and the Treasury Department finally having come to this understanding on the administration of the act, the Secretary of the Treasury published in a Treasury bulletin of June 12, 1939, a statement providing essentially for the consideration of the costs of new plant equipment as above when reckoning the profits on a contract. The manufacturers still were doubtful as to whether they would be reimbursed for expenditures for equipment, as this depended upon the manner in which the regulations in this bulletin were administered.

To dispel this fear, the Secretary of the Navy obtained from the Secretary of the Treasury on July 19, 1939, an agreement whereby the Treasury will negotiate with contractors in advance of entering into a new contract, definitely allowing the contractors to include as part of their costs not in excess of fifty per cent of the original cost of the machinery they install, if the necessity for installation is certified to by the Secretary of the Navy. The balance of the original cost of machinery, which may be allowed as the cost of performing the contracts, is to be determined in accordance with the Treasury Department's rulings and regulations under the Vinson-Trammell Act. Even after securing this understanding on the manner of administering the law, it will take honest coöperation on the part of private industry, naval inspectors, and Treasury officials to make this arrangement work smoothly to the end that procurement will not be delayed.

IN the closing hours of the last regular session of Congress, a deficiency bill, approved August 9, 1939, provided $6,000,000 "for the procurement and installation of special facilities for use by contractors in manufacturing armor for naval vessels." This money will be used chiefly where installations are made for armor production in Government plants where there is no question as to retaining title to all facilities installed.

The agreement between the Treasury and Navy Departments in their letters of July 19, 1939, described above, is considered best, both for the private manufacturer and for the Government, as allowing the former his costs and giving the latter its desired production and regulation of costs.

The extension of the principle involved herein to other Government procurement under the Vinson-Trammell Act would be appropriate only where there was definite assurance that the technical bureau or department making the contract had technical inspectors sufficiently well qualified in the manufacturing plants to determine whether or not certain machinery was in fact required for the performance of the contract.

The use of this principle of amortization of costs of equipment would also have to be guarded in order not to lead to the indiscriminate setting up in business of unqualified and inexperienced would-be manufacturers. The Navy uses it only to expand reputable and experienced plants of good financial standing with well-trained mechanics. It should in no way be confused with the educational orders used by the Army.

The laws passed to secure fair prices to the Government, to improve the conditions of labor, fix minimum wages, and to regulate disputes between labor and manufacturers, have operated to make the private manufacturer take a greater risk than formerly in taking a Government contract. But I have observed in my dealings with the executives of a number of companies that, although some features of these laws are irritating and objectionable to them, they finally are able to adjust themselves to the conditions imposed, and they continue to do business with the Government. There is always a fair and just road on which both private industry and Government can travel together in the closest coöperation and good will with great benefit to both industry and the Government. I have found private industry more than willing to coöperate, and I acknowledge a great debt to the patriotic and arduous labor of a host of individuals in private industry. At the same time, as a Government official, I can see the advantage to the Government and to labor of such acts as the Vinson-Trammell Act and the Walsh-Healy Act, if they are properly administered, and I predict that it will be only a matter of time until the Congress extends the provisions of the Vinson-Trammell Act to apply to all Government procurement, thus limiting profit on all Government contracts.

# The Ordnance of Our Army

*In these eight pages are shown the principal types of ordnance now standard for the United States Army. They embody the more recent developments of military engineering and represent modern practice as applied to tactical design and quantity production. These are the pieces with which our military forces are now being equipped, and they should be familiar to all American engineers and to our people generally.*

*The U. S. rifle, caliber .30, M1—the Garand semiautomatic—above, was adopted as the standard shoulder rifle for the Army in 1936 after 30 years of experimentation. It weighs about 9 pounds, has a muzzle velocity of 2,700 feet per second and can be fired accurately 2¼ times as fast as the 1903 Springfield rifle, which it supplants.*

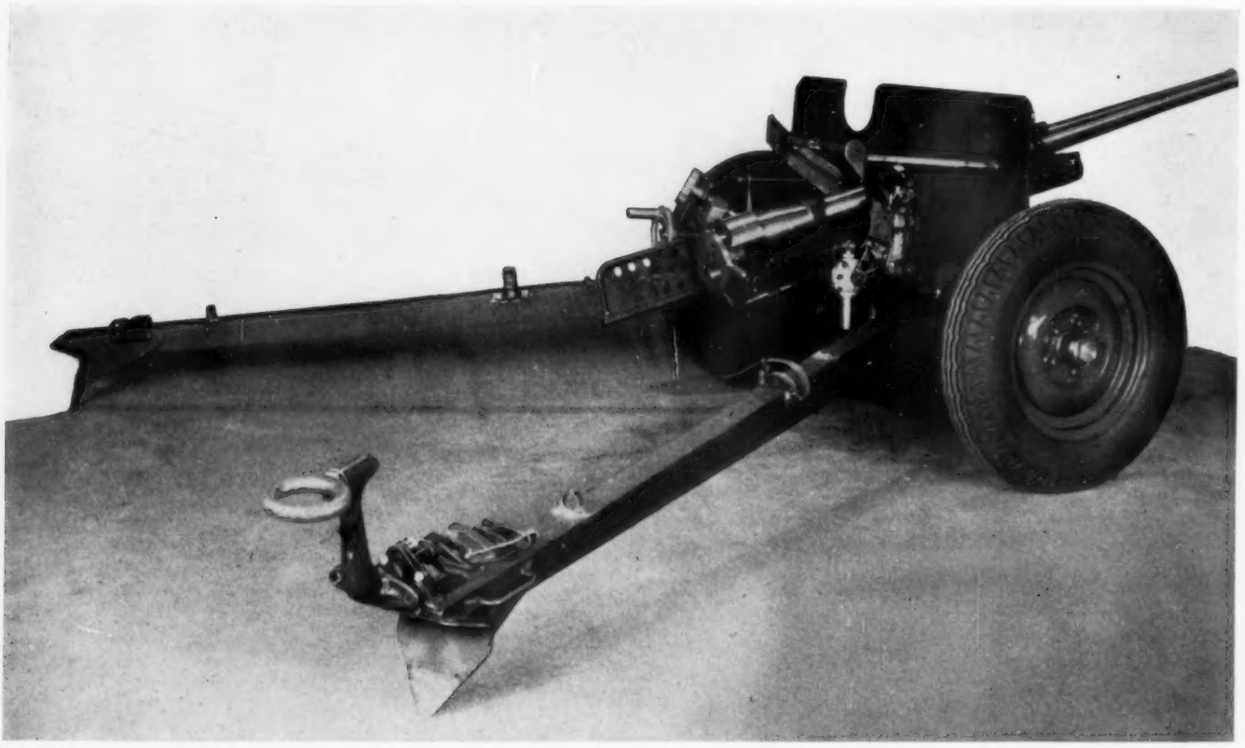
BY definition, the functions of the Ordnance Department are "to design, procure, store, supply and maintain the ordnance and ordnance stores of the United States Army, including artillery, artillery ammunition, small arms, bombs and all munitions of war which may be required for the fortifications of the Army, the armies of the field, and for the National Guard." The Department performs all the engineering necessary to investigate and construct experimental ordnance matériel for adoption by the Army, prepares the necessary regulations for proof, inspection, storage and maintenance, as well as the manufacture and inspection of such equipment for current use and such reserves as are prescribed.

The weapons here shown have been designed and produced by the Department in conformity with the above functions. Limitations of space prevent a more complete presentation, but from time to time ARMY ORDNANCE will describe such weapons as have become standard and are in use by our armed forces.

This series, starting with the semiautomatic shoulder rifle, shown on this page, includes machine and antitank guns, field, seacoast, and antiaircraft artillery, and tanks. These are the principal weapons used by the various fighting services of our Army. There are, of course, literally hundreds of other items of ordnance equipment. Essential among these are the various kinds of ammunition without which the weapons here shown are not weapons at all. Indeed, one of the greatest of all ordnance problems is an adequate supply of ammunition of every caliber.

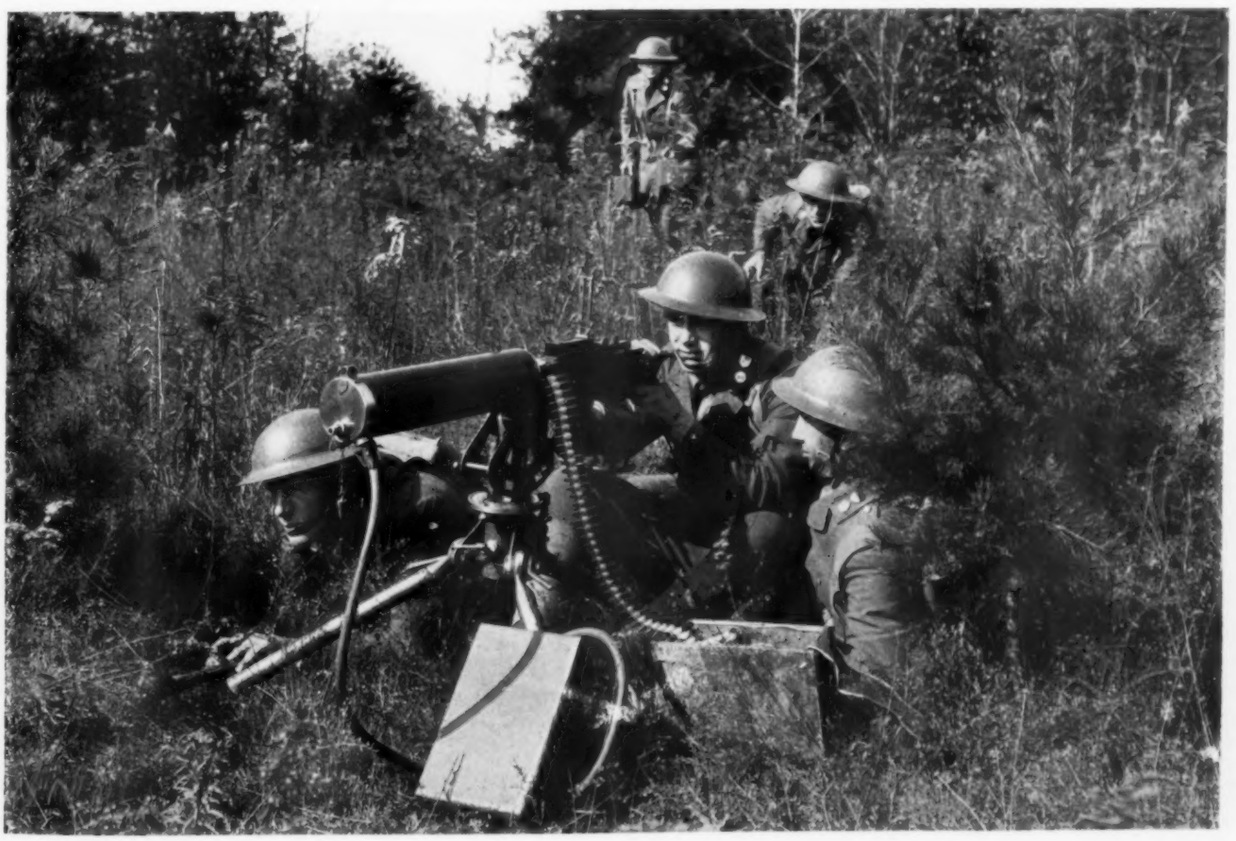
*International*

# *Antitank and Antiaircraft Guns*



*The 37-mm. antitank gun, above, recently has been adopted for use by our Infantry. It fires an armor-piercing projectile capable of penetrating 1½ inches of armor plate at 1,000 yards. The 37-mm. antiaircraft gun for defense against low-flying airplanes, below, is capable of 120 shots a minute, full-automatic fire (Signal Corps photo).*

# Machine Guns



*The caliber .50 Browning machine gun on antiaircraft mount, above, can fire approximately 400 rounds a minute to a horizontal range of about 4 miles. The caliber .30 Browning machine gun, below, has a maximum rate of fire of 500 rounds a minute and a range of about 3 miles. Both guns are recoil-operated (Signal Corps photos).*

## *Medium Artillery*

*The 75-mm. howitzer on high-speed carriage, above, is the light artillery weapon used by the Cavalry division, horse or mechanized. Below is shown the 75-mm. gun on the new standard high-speed carriage which increases elevation from 19 to 45 degrees, traverse from 6 to 85 degrees and range from 9,700 to 13,500 yards (Acme photos).*

# *Heavy Artillery*

*The 155-mm. howitzer adapted to high-speed transportation is shown above. Use of pneumatic tires and air brakes has increased the possible speed from 10 to 50 miles an hour. Range: about 7 miles (Acme photo). The 155-mm. gun on high-speed carriage, below, fires a 95-pound projectile 26,000 yards at a maximum elevation of 45 degrees.*

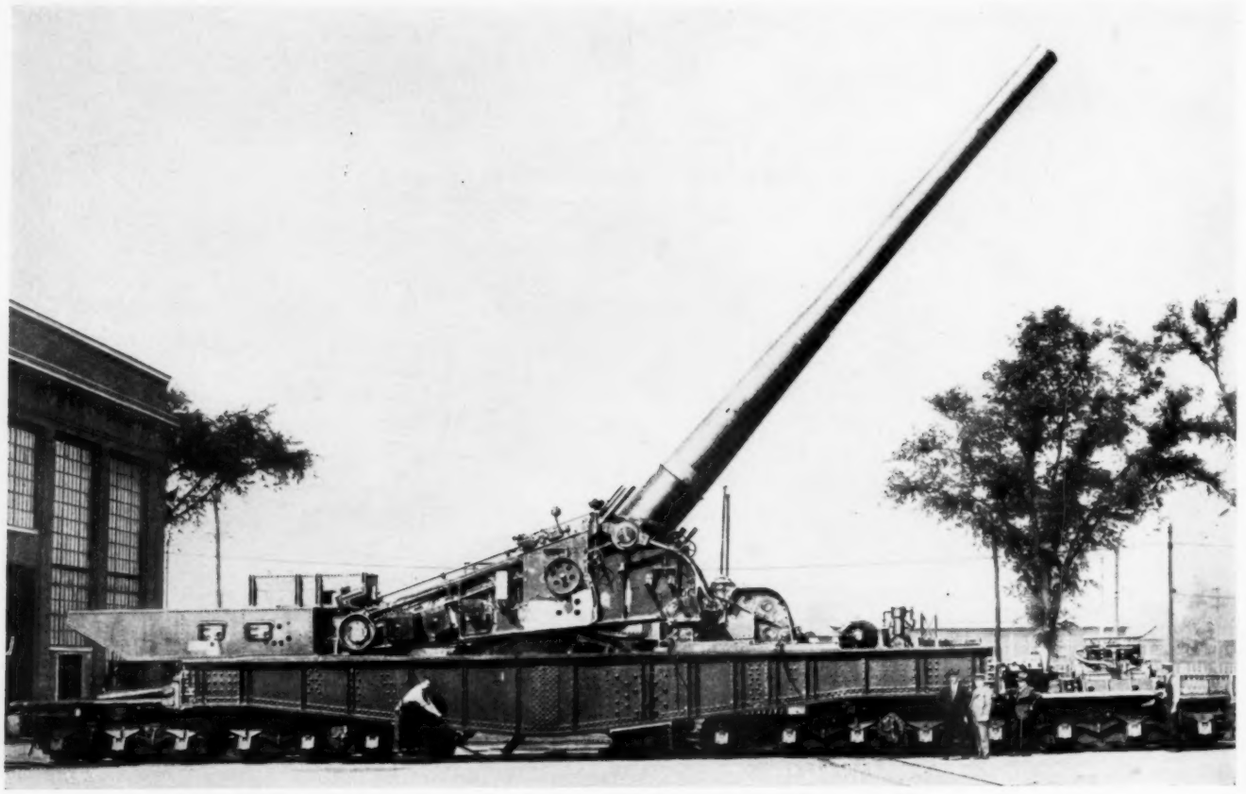
# *Tanks*

*The new medium tank, above, is a larger, heavier and slower vehicle than the new light tank shown below. More heavily armed and armored, it is for sustained attack against strong defensive positions (Acme photo). The light tank carries one 37-mm. cannon and four machine guns, and is for use with the Infantry. It has a speed of 35 miles an hour.*

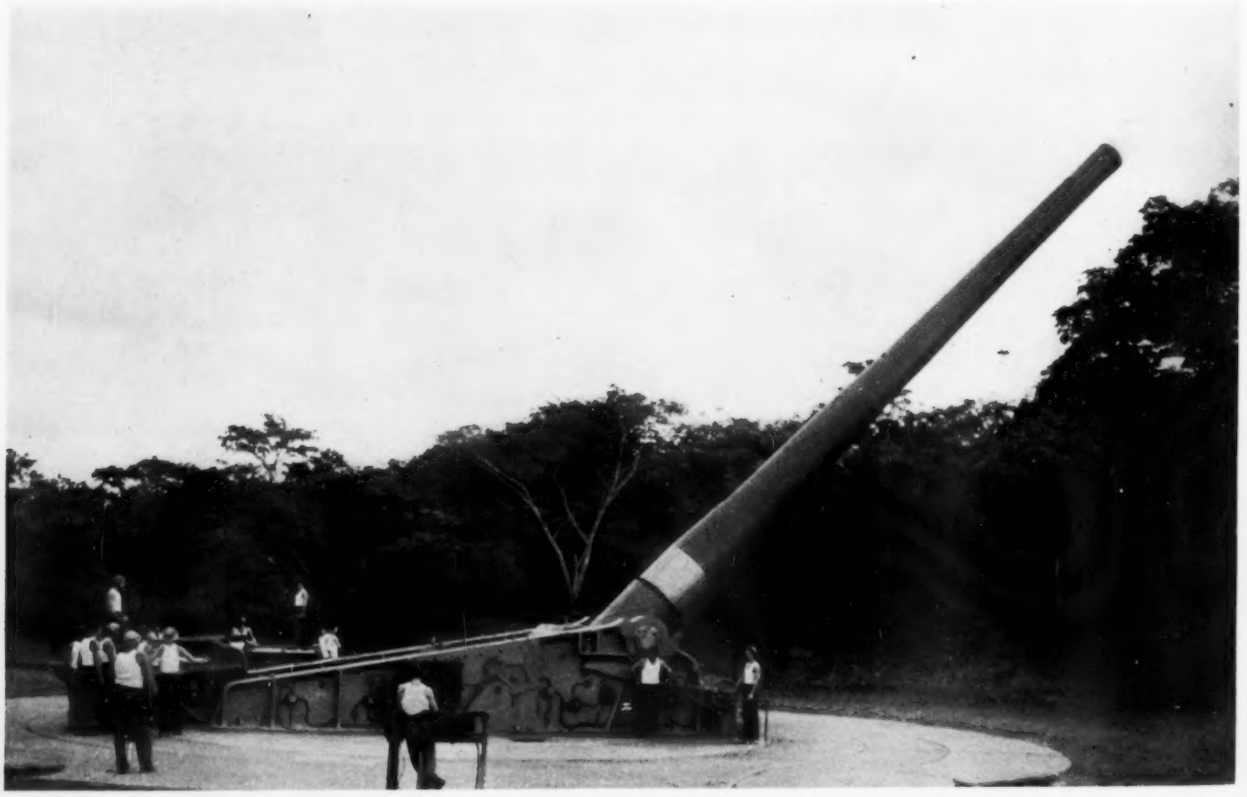
# *Antiaircraft Artillery*

*The 105-mm. antiaircraft gun, above, fires a 33-pound projectile vertically about 14,000 yards and horizontally about 21,000 yards (International photo). The 3-inch antiaircraft gun, below, fires a 12.7-pound projectile vertically 9,700 yards and horizontally 14,200 yards. Its rate of fire is 25 shots a minute (Signal Corps photo).*

## *Seacoast Artillery*



*The 14-inch seacoast gun on railway mount is shown above. This coast-defense weapon has a maximum range of about 25 miles with a 1,560-pound projectile. The 16-inch seacoast gun on barbette mount, below, is the largest coast-defense gun in our service. It fires a 2,100-pound projectile to a range of about 30 miles (International photo).*



# Antiaircraft Armament

## *The Guns and Fire Control for Air Raid Protection*

By Col. G. M. Barnes*

ABOUT one-fifth of all enemy airplanes destroyed by the Allies in the World War were shot down by antiaircraft gunfire. Nevertheless, many American officers and the great majority of the people in civil life have doubted the ability of antiaircraft to compete successfully with aircraft—especially since the latter has improved beyond all predictions as an instrument of commerce and war.

There were good reasons for doubting the efficacy of the antiaircraft matériel existing at the close of the World War. Until 1925, the guns and fire-control instruments were crude and improvised. The popularity of antiaircraft artillery as a means of defense reached a low in this country about 1924-1925 when the subject was investigated by a special committee of Congress. As the opinions of the various military experts consulted by this committee were widely divergent regarding the efficacy of this equipment, nothing definite, in as far as antiaircraft defense was concerned, came from the investigation.

Maj. Gen. C. C. Williams, then Chief of Ordnance, feeling that this controversial subject should be thoroughly investigated, addressed a letter to the Secretary of War requesting that extensive antiaircraft tests be held, using the matériel then available, so that its efficiency and defects might become known. As a result, tests were held at Fort Tilden in 1925, and the effectiveness of the guns and fire control then in existence was established under target-practice conditions.

Using the information obtained from these tests as a basis, an intensive program for the development of all items of antiaircraft artillery was inaugurated by the Ordnance Department. There has been rapid improvement ever since, and for several years the United States led all foreign countries in the excellence of its equipment. During more recent years, with the large sums available for extensive rearmament programs the European nations have reached high standards of quality in their guns and fire-control instruments. These nations are now more or less equal in this respect. Important differences, however, may exist in the amount of equipment available to the various European nations.

A brief survey of the latest items of antiaircraft matériel follows in order to orient the reader with the more recent improvements in this class of defense equipment.

SEMIAUTOMATIC SHOULDER RIFLE.—One of the most difficult tasks of antiaircraft defense is that of providing protection to the front-line soldier against low-flying airplanes. The "hedge hopper," as the low-flying airplane is sometimes called, can take advantage of cover and approach its objective often unseen until it is over the target. Because of the high speed the airplane can attain, a very short time will elapse between its approach and the dropping of bombs or the firing of machine guns against front-line troops. The newspapers have given accounts of the effective work done by such low-flying German aircraft over the Polish lines where, apparently, few suitable weapons were available for defense.

It has been known for several years that trained riflemen could score hits against low-flying aircraft with the Springfield shoulder rifle. A new weapon which shows great promise in combating the low-flying plane recently has been adopted by the Army. This new weapon is the semiautomatic shoulder rifle, caliber .30, M1. It is similar to the Springfield rifle in weight and ballistic characteristics, but it possesses one important advantage—more rapid fire. This rifle can be fired by the average soldier approximately 2¼ times as tast as the Springfield rifle. An interesting experiment was conducted which illustrates the value of this semiautomatic rifle as a weapon of defense against the airplane. An Infantry officer trained a group of ten enlisted men to fire at approaching sleeve targets towed by airplanes at low altitudes. After a period of training, records indicated that a large percentage of hits was possible.

ANTIAIRCRAFT MACHINE GUNS.—Another item of defense equipment against low-flying aircraft is the machine gun. Both caliber .30 and caliber .50 machine guns are employed for this purpose by the United States Army. The machine gun, having a high cyclic rate, is able to form a pattern of shots, thereby increasing the probability that hits will be secured. Improvements in antiaircraft machine guns since the World War have provided higher cyclic rates, more stable gun mounts, and more effective methods for directing accurate fire. The caliber .50 machine gun, while much less mobile than the caliber .30, has the advantage in that its projectiles are heavier, can produce greater damage, and give a more brilliant trace. Tracer bullets are depended upon principally to aid in keeping the stream of fire directed at a moving target.

The distant control of the sighting mechanism is an important feature of the latest type of caliber .50 machine-gun mount. The gunners point the machine guns by aiming their sights at the airplane. The sight deflections, both vertical and horizontal, for all guns of the battery, are controlled from a central point. At this central point, firing data may be introduced into the system by using a lead computer, by means of spotting observations made from the flank of the battery, or by a combination of both methods. The maximum effective range for machine guns firing at aërial targets may be taken as 2,000 yards. At ranges greater than this, the pattern becomes too scattered and the errors in estimating lead by tracer bullet, lead computer, or flank observation, become too great for effective fire.

37-MM. ANTIAIRCRAFT GUN.—It is known that a single hit with a rifle or machine-gun bullet will not necessarily damage an airplane seriously. In fact, an airplane may execute its mission even though it has been struck by many such bullets. Hence there arose the need for a weapon small in caliber, so that it would be mobile and available for use in the defense of front-line positions, but with greater destruc-

*Chief, Artillery and Automotive Division, Technical Staff, Office of the Chief of Ordnance. Colonel, Ordnance Department, U. S. Army.

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tive effect than the caliber .50 machine gun. The 37-mm. antiaircraft gun was introduced to provide such a weapon. This fully automatic gun fires at the rate of 125 rounds per minute. The projectile, weighing about 1 1/3 pounds, has an instantaneous fuze designed to detonate its charge of high explosive upon striking any part of the airplane. The projectile also contains a self-destroying element so that in case the airplane is not struck, the shell will explode after it has traveled a predetermined distance. Tests against airplane structures with this ammunition have proved that the 37-mm. projectile will do serious damage. It is doubtful whether any bomber could survive more than two or three such hits.

An elaborate fire-control system is required with this type of weapon as the gun must be directed very accurately at the airplane in order to score hits. All the sights of the 37-mm. gun battery are set automatically by means of a transmission system from a distant central point. A lead computer—a machine for automatically calculating firing data—continuously determines the vertical and lateral deflections. The gunners are required only to keep the gun sights directed at the on-coming airplane.

Caliber .50 Antiaircraft Machine Gun in Action

Most foreign countries have adopted similar intermediate-caliber guns. The Germans use an automatic gun having characteristics quite similar to our own. The British are using the 40-mm. automatic Bofors gun which, although larger in caliber, fulfills the same general function. The maximum effective slant range for this type of weapon may be considered to be 3,000 yards.

3-Inch Antiaircraft Gun.—One of the reasons for failing to attain even greater results with World War equipment was that time had not been available for developing and designing the special types of antiaircraft artillery required. The problem involved was that of producing a mount for the gun which could be transported easily from one place to another and emplaced quickly; yet one which, when set up, would remain level during firing. These problems have been solved, and guns and mounts now are available which make possible delivery of the accurate fire so necessary for success in combating the speedy bomber. A battery of four antiaircraft guns will average one hundred aimed shots per minute. The maximum effective ranges for the 3-inch antiaircraft gun may be taken as 20,000 feet altitude and 7,000 yards slant range.

105-mm. Antiaircraft Gun.—The 105-mm. antiaircraft gun was designed with the objective of increasing the maximum range at which targets could be brought under effective fire. The maximum vertical range of the 105-mm. antiaircraft gun is 41,000 feet and the gun may be used for effective firing to some 12,000 yards maximum slant range.

Fire-control Equipment.—The fire-control system for directing the fire of the gun at the target is the heart of the antiaircraft battery. Prior to about 1926, guns were aimed by means of sights placed on the gun carriages. The data for setting the sights were manually computed, using several separate instruments. After the answers had been obtained through combining the results secured from these various instruments, these data were telephoned to the gunners and the sights then set.

The guns were either laid to shoot directly at the targets or, under other systems, it was attempted to establish a curtain of flying fragments through which it was anticipated the enemy airplane would travel. By continuously firing the gun and keeping the barrage ahead of the airplane, it was expected that destructive hits would result. Calculations of the probabilities of hitting proved the fallacy of this idea. It was found that hundreds of thousands of rounds of ammunition would be required to fill the great volume of space surrounding the airplane. This so-called "cloud method" of fire control finally was abandoned and the present system, based upon using the gun as an instrument of precision, was substituted.

Director.—The defects of the existing fire-control systems were recognized and the demand for a better system arose. This requirement brought about the development of the director, a mathematical instrument designed to compute automatically and continuously the firing data required by the guns of an antiaircraft battery. This instrument is perhaps the most complicated mechanical instrument manufactured for any purpose. It is boxlike in appearance and mounts two telescopes for use by the gunners in tracking

the target. The act of directing these telescopes continuously at the target sets up within the instrument rates of travel of the aircraft in the verical and horizontal planes, thus generating the path of the airplane and determining its instantaneous position, range, and ground speed.

The only external measurement required is the altitude of the airplane, and this is set into the machine. The director determines the instantaneous range from the battery to the target and selects the time of flight of the projectile corresponding to this range. It multiplies this time of flight by the speed of the airplane to determine the position the airplane will reach upon the arrival of the projectile at the same point in space. A new range to this set-forward position is then obtained, with its corresponding time of flight. This last time of flight is utilized to re-compute the travel of the target during travel of the projectile, thereby arriving at a new set-forward position more nearly correct. This process is repeated until the machine, through integration, smoothes out the results and finds, accurately, the predicted set-forward position of the target.

The director also adds the ballistic corrections due to the action of wind, drift, and variations in muzzle velocity. The machine generates continuously the azimuth and elevation corresponding to the set-forward position of the target, and these data are transmitted to the battery by an electrical transmission system where they appear as deflections of a pointer. The gunners have only to train the guns in accordance with the indicated data. The fuze setting, also computed by the director, is likewise electrically transmitted to a fuze-setting machine and the fuzes continuously set. This is a new kind of artillery fire control exceeding in speed and accuracy anything heretofore developed for the artilleryman.

HEIGHT FINDER.—An essential instrument of the fire-control system is the height finder which is used to supply the director with accurate information as to the altitude of the enemy target measured in yards vertically above the ground. This information formerly was obtained by means of two instruments located at the ends of a measured base line and interconnected by telephones. While accurate determinations of altitudes were possible, the time required was prohibitive. A still greater difficulty was caused by the distance, usually about 2,000 yards, between the stations, making it almost impossible to insure that both observers at all times followed the same target. With numerous airplanes in the sky, many serious errors were possible.

The modern antiaircraft height finder combines both end stations in a single optical instrument. One observer, assisted by trainers who keep the height finder oriented with the target, makes the altitude determination. These instruments are costly and complicated, requiring great optical knowledge and skill in their design and manufacture. The facilities for producing these instruments in most countries are so limited that unless an adequate supply is obtained in time of peace, there is small possibility of having height finders in sufficient quantity to supply antiaircraft batteries in war time. A simple instrument for achieving this same result has been sought for many years, but the stereoscopic height finder at present remains the most suitable instrument for the purpose.

AMMUNITION.—While great progress was being made in working out new types of antiaircraft guns and more accurate fire-control equipment, a parallel development was taking place in the improvement of the ammunition. It is essential that the time of flight of the projectile be reduced to a minimum, since the airplane travels during this time and may change its course from that predicted. The time of flight of the projectile can be reduced in two ways. First, by increasing the gun muzzle velocity and, secondly, by improving the ballistic flight characteristics of the shell. The biggest dividends are obtained by a combination of the two. A projectile of poor ballistic shape would lose its velocity rapidly, and consequently very little decrease in time of flight would be secured by increasing the muzzle velocity.

On the other hand, by designing the projectile to give the best practicable streamlined shape, the air resistance is materially reduced which, in turn, causes a minimum reduction in velocity and a considerable decrease in time of flight to a given point in space. The modern antiaircraft projectile has been designed to give these desired characteristics.

The accuracy of the time fuze with which the antiaircraft projectile is equipped is of first importance. The shell must be timed to explode just short of the airplane to insure that the fragments from the bursting high-explosive shell will be thrown against it. If the burst occurs within fifty yards or, in some cases, even a greater distance from the airplane, the latter probably will be destroyed or seriously damaged by high-velocity shell fragments.

During the World War, most countries used a powder-train fuze, the accuracy of which depended upon the rate of burning of compressed black powder. The rate of burning of this type of fuze is affected by the angular velocity of the projectile and by the altitude. This fuze was satisfactory for the field gun which was fired at low elevations, giving low altitudes. However, when used in antiaircraft ammunition, the time of burning was found to vary materially with the altitude. For example, at a given fuze setting, the time of burning varied from eighteen seconds to thirty-three seconds as the elevation of the gun was increased. This required the use of a conversion table which would take into consideration both the altitude at which the projectile was to burst and the range. Corrections were made for these variations by means of a 3-dimensional cam in the director, and errors naturally were involved in this conversion.

Most countries now use mechanical fuzes, the timing of which depends upon a clock mechanism and is unaffected by the altitude or range. The mechanical fuze thus has contributed greatly toward accurate and effective fire. But mechanical fuzes are expensive and difficult to manufacture and are a military luxury which can be afforded only by first-class powers.

SEARCHLIGHTS AND SOUND LOCATORS.—For antiaircraft defense at night, equipment is necessary by which the enemy can be located, illuminated, and then tracked by the fire-control instruments of the battery. For the purpose of locating the airplane in the dark, the sound locator has been developed. It may be likened to a wide-angle telescope in that it covers a wide field and, in addition, amplifies—not the object but the sound detected. It is reported occasionally that guns are aimed automatically by means of sound locators. This cannot be done since sound travels about 1,130 feet per second and, therefore, a relatively long period is required for the sound to reach the battery. Although corrections for the sound lag and other variations can be made, the derived position of the airplane would be too indefinite to be used as a means of directing gunfire.

*International*

ARMY ATTACK BOMBERS IN FORMATION

However, the determinations as to airplane position made by the sound locator are sufficiently accurate to guide the searchlight to the approximate position of the airplane. After the enemy craft has been located by the sound locator, the data are transmitted electrically to the searchlight which likewise tracks the airplane. The light shutters are opened, and usually very little searching is required before the airplane appears in the beam. Very powerful searchlights are used to extend the range of the pick-up as much as possible. In this country, a 60-inch mobile searchlight, having 800,000,000 candle power, is employed.

Field tests made at various times have indicated that it will be difficult for bombing squadrons to make night attacks on defended areas without being detected by the sound locators and searchlights. Darkness adds to the difficulties of the antiaircraft gunners, but the difficulties of night bombing also must be taken into consideration. Once an airplane has been picked up by a searchlight, it normally cannot free itself from the searchlight beam by maneuvering. With the target illuminated, the fire of the battery would be as accurate as in the daytime, since the same methods of fire control and battery operation are employed.

FOREIGN ANTIAIRCRAFT MATÉRIEL.—The antiaircraft matériel used throughout the world by nations leading in military equipment is remarkably similar, with some variations of caliber. The British use 3-inch, 3.7-inch, and 4.5-inch guns; the French, 90-mm. (3.54-inch) guns, while the principal German antiaircraft gun is an 88-mm. (3.43-inch). The tendency today seems to be toward the use of calibers larger than 3 inches in order to reach higher to meet the increasing altitudes at which the modern bombing airplanes can fly.

The same may be said of the fire-control equipment which is remarkably similar considering that the research and development work has been done more or less independently by these various nations. The majority of countries now use the Case III system of fire control, which is the system described above—the airplane being followed by the telescopes of the director, the altitude being measured by the optical height finder, and the computed data being transmitted electrically to the firing battery while the gun is being trained in azimuth and elevation by the follow-the-pointer method.

On the other hand, perfection in quality of equipment is of little avail unless sufficient quantities are on hand to meet the requirements of the military forces. If your enemy possesses a very large number of aircraft and attacks with great force, the fact that a few antiaircraft guns are available which could defend against a few airplanes would not have a material effect upon the outcome of the attack. The cost of the modern antiaircraft battery is so great that it is prohibitive for small nations to adequately provide for sufficient quantities of guns and ammunition to meet air attacks from a strong neighbor. For this reason, great care must be taken in belittling the lack of results obtained by small or unprepared nations in attempting to defend themselves against aërial attack. Only the very latest and most highly developed antiaircraft guns and fire control can be put into action successfully against the modern bomber.

TARGET-PRACTICE RESULTS.—Modern antiaircraft matériel has been available to the Coast Artillery troops in this country for the last twelve years. During this period, these weapons have been undergoing almost continuous service tests. Thousands of rounds have been fired at sleeve targets towed by airplanes at various altitudes and ranges. Tests have included firings by single batteries and by groups of several batteries arranged to simulate the defense of a vital area. From these records, it has been established that hits can be made within the limitations of the various calibers as to ranges and altitudes. These weapons give promise of being effective against bombing attacks. This appears to be the best information which is obtainable under peace-time conditions.

RESULTS IN WAR.—Military authorities have been very desirous of obtaining a true evaluation of the efficacy of this new type of artillery. The more recent wars so far have failed to give satisfactory answers. In Ethiopia, there was no defense to oppose the free operation of the Italian air force which unquestionably contributed to Italian victory.

In the first days of the Chinese struggle against the Japanese, it was thought that perhaps valuable information concerning the efficiency of the aircraft against naval targets would develop. The Chinese had a small air force with limited training in bombing. The Japanese warships were lying at anchor in the Yangtze, opposite Shanghai. These ships should have been very easy targets. There were reports that the Chinese did attempt to bomb these ships, but the bombing was wild, and one report revealed that this lack of accuracy was due to antiaircraft fire from the enemy ships.

During the Spanish Civil War, the most impressive results were achieved by the German antiaircraft matériel. The Germans brought to Spain a limited number of their latest types of weapons and fire-control instruments with trained crews for General Franco's use. However, the Spaniards were not allowed to have anything to do with this equipment which was manned throughout by German personnel. The Germans set up the guns, employed them against Loyalist planes, principally from Russia, kept records of the results, and then packed up the equipment and transported it back to Germany. Thus the Germans had an opportunity to test their equipment under war conditions. The results have

been kept secret. Spanish and neutral observers who witnessed the firing of the German antiaircraft matériel stated that a large percentage of hits was secured.

The Polish antiaircraft matériel was apparently insufficient in quantity to make any impression upon the formidable German air force. One unofficial account has credited the Poles with having destroyed some three hundred German planes. While information undoubtedly is available as a result of the fighting in Poland, it will have to be analyzed very carefully before worth-while conclusions can be drawn.

The British, almost immediately upon the declaration of war, made an attack upon the Kiel Canal and the German pocket battleship anchored there. According to newspaper and radio accounts, the British made this attack in heavy weather and their arrival over the target was a complete surprise to the Germans, as indicated by the fact that clothes were still hanging on lines on the deck of the battleship. The British delivered their attack, but even before the attacking airplanes could leave the scene they were brought under gunfire. The Germans state, and the British admit, that there were airplanes lost in this attack. Somewhat later, there were reports of a French attack upon the zeppelin plant at Friedrichshafen (now a munitions factory) on Lake Constance. Another incident was the attempted bombing by the Germans of the British fleet in the North Sea. The British report no losses and have stated that the German raiders were driven off with the loss of two bombers. Recent unofficial reports state that all belligerents in three weeks of warfare have lost over one thousand airplanes. This destruction may presage the great expenditures of aircraft matériel to be expected in the coming months, if aërial warfare is accelerated.

As the fighting develops between Germany, France, and England, many instances doubtless will occur and from a careful study of the results, when true reports are obtainable, evaluations can be made which should lead to sound conclusions as to whether the modern antiaircraft gun can fulfill its mission of defending vital facilities on land and at sea. It should not be expected that air attacks against such targets always will be completely defeated. The important question to be answered is whether the gun can make such attacks so expensive to the enemy, in valuable airplanes lost and trained men killed, that their continuation throughout a war would be unprofitable.

It appears that the three great nations involved in the present struggle are conserving their air forces and are refraining from carrying out extensive attacks upon important enemy installations. Is this restraint due to the fear that effective antiaircraft defense will so weaken their air forces, which cannot be quickly replaced, as to make such operations prohibitive? If it is found that antiaircraft defense weapons can exact so great a toll from attacking aircraft as to make this kind of warfare unprofitable when losses are balanced against achievements, then all the cost and effort expended on antiaircraft artillery will have paid rich dividends.

THE ANTIAIRCRAFT DIRECTOR IN OPERATION

# Lehigh-Bethlehem Post, A. O. A.

## *New Chapter Inaugurated by Engineering Students of University*

HONORED by the presence of Dr. C. C. Williams, president of Lehigh University, and of Capt. C. Wingate Reed, personal representative of Maj. Gen. C. M. Wesson, Chief of Ordnance, United States Army, a new local unit of the Army Ordnance Association was formed at Bethlehem, Pa., November 15, 1939. The new Post was organized by Capt. B. S. Mesick, Ord. Dept., who is in charge of the Ordnance Unit, R.O.T.C., at Lehigh. The charter of the new chapter was presented on behalf of Brig. Gen. Benedict Crowell, president of the Army Ordnance Association, by Lieut. Col. L. A. Codd, Ord. Res., executive secretary of the Association. The inaugural meeting, at which eighty members were in attendance, was held at the Bethlehem Club. E. G. Uhl, Lehigh '40, newly elected president of the Post, presided.

Doctor Williams, in a brief address, presented the greetings of the university to the officers and members of the new chapter and extended best wishes for the success of the organization. Captain Reed, in conveying the felicitations of the Chief of Ordnance, dwelt upon some interesting historical facts in the development of the Reserve Officers' Training Corps. In elaborating upon this point he said:

"Shortly after the Armistice, three organizations were reorganized or newly organized to prevent a repetition of this condition (unpreparedness). These media were the R.O.T.C., as it is organized today; the Officers' Reserve Corps, and the Army Ordnance Association. All these organizations have done excellent work in their particular fields toward the fulfillment of their mission.

"The R.O.T.C. is by far the oldest. Its real founder was Jonathan B. Turner of Illinois. He believed the Government should encourage the establishment of colleges where young men could learn the agricultural and mechanical arts. As a result of his persistent efforts the so-called Morrill Land Grant Act was passed by the Congress in 1862. This act gave large grants of land to each state to found an agricultural and mechanical college. Military training was included in the curriculum.

"At the beginning, this military training was not supervised by any Government agency. Each college gave such training as it believed met the requirement. In 1887, the Department of the Interior was made responsible for the conduct of the units, but the War Department sent one instructor to each of the more important colleges. General Pershing was at one time on this duty at the University of Nebraska.

"In 1907, the War Department began inspecting these units and the rating of 'Distinguished College' was created. A limited number of honor graduates from these 'Distinguished Colleges' were commissioned direct in the Regular Army. The National Defense Act of 1916, as amended in 1920, created the R.O.T.C. as it is today.

"The Officers' Reserve Corps had its inception in the Plattsburg Training Camps organized by Maj. Gen. Leonard Wood and sponsored by the late President Theodore Roosevelt. The War Department decided this was an excellent idea, and the National Defense Act of 1916 created the Officers' Reserve Corps to take care of the R.O.T.C. graduates and provide a reservoir of trained officers for an emergency. This organization was also changed in 1920 to approximately what it is today.

"THE Army Ordnance Association is the youngest of the three organizations. Its creed was simple: 'Industrial preparedness is the nation's strongest guaranty of peace.' The purpose of the Army Ordnance Association was to prepare industry for its part in the next war, should such an unfortunate event again occur. This has been no easy task. For twenty years the Ordnance Department and the Association have stuck determinedly to this creed. Procurement districts have been organized throughout the industrial centers of America. Industry has been interviewed and its facilities catalogued. Government methods of doing business have been explained. Drawings, specifications, and contracts have been examined, and the war-time requirements of the Army have been tentatively allotted to the various plants most capable of producing them. The Army Ordnance Association gives opportunity to coördinate your civilian and military activities. Contacts made in this organization will be valuable both in your vocation and your avocation. Today, the Association is approximately five thousand strong. Its membership includes outstanding industrialists, engineers, and business leaders of the country. Its posts extend from Boston to Los Angeles. Industry is now quite conscious of its responsibilities. It is your responsibility as members to see that it remains so."

Among those present at the inaugural meeting were: Col. J. S. Leonard, professor of military science and tactics at Lehigh; Lieut. Comdr. G. B. Linke, naval inspector at Bethlehem Steel Company; Lieut. Col. H. A. Hall, Inf. Res., Allentown, Pa.; R. A. Cary, C. F. Lincoln, Jr., K. H. Zornig, R. Caemmerer, C. H. Carter, Jr., C. F. Kalmbach, A. E. Lee, Jr., R. J. McNamara, R. M. Shepherd, B. Altshuler, F. P. Glueck, R. S. Grubmeyer, F. Kornet, Jr., R. V. Mackey, Jr., J. F. McQuillin, W. M. Schweder, J. W. Temple, H. W. Thomas, W. W. Ache, P. G. DeHuff, R. C. Kelley, R. F. Koenig, W. G. Leonard, D. MacFeeters, E. P. Phillips, W. B. Pohlman, W. B. Wrigley, R. I. Felch, A. C. Foss, Jr., W. K. Hodson, G. F. Messinger, R. L. Stubbings, A. H. Thomas, R. C. Engle, G. S. Coopey, D. Eadie, W. J. Feigley, A. M. Karwacki, R. E. Malinowski, J. H. Mathewson, L. J. McKinley, H. G. Werner, R. Cheli, F. J. Harrold, Jr., F. W. Nadig, W. H. Vogelsberg, and Allen H. Zaney, Jr.

Also, Profs. F. V. Larkin and L. Whitcomb, of the Lehigh faculty; D. G. Williams, Allentown; Walter O. Snelling, Trojan Powder Company, Allentown; Alvin J. Storigel, Trojan Powder Company; K. J. Schatzlein, Allentown; D. A. Marshall, Bethlehem; P. E. McKinney, Bethlehem Steel Company; F. M. D. Bottenfield, Trojan Powder Company; G. P. Witteman, Bethlehem Steel Company; W. Snadecki, Bethlehem Steel Company; Samuel Gladding, Bethlehem Steel Company; E. L. Marchant, Bethlehem Steel Company; Thomas D. Shannahan, Bethlehem Steel Company; L. F. Unger, Allentown, Lehigh-Portland Cement Company.

# Cartridge Case Manufacture

## *More Production Engineering for Artillery Ammunition*

By Lieut. Col. Levin H. Campbell, Jr.*

ENGINEERING drawings are *not* production drawings! The import of this statement must be understood thoroughly at the start. How thoroughly may be indicated by recalling the enthusiastic reaction of production engineers in commercial industry to an artillery shell recently designed by the Ordnance Department and on which they had submitted bids. Their prices told the story even better than their words. Hence this article is written at the specific request of the editor of ARMY ORDNANCE in the belief that detailed information on cartridge-case manufacture may be of value to commercial industry in the production of such armament. It also is written in the hope that the importance of production engineering in all ordnance work may receive the serious consideration to which it is entitled by all of us.

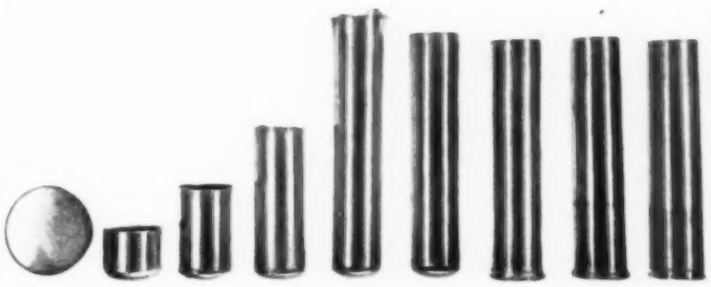

FIG. 1. MANUFACTURING STAGES OF THE 75-MM. CARTRIDGE CASE
Disc thickness (left) 0.45-inch; length of final draw (center) approximately 16 inches

We have attacked the production problem at the Frankford Arsenal with two cardinal principles in mind: First, that the quality and dimensions of manufactured articles must meet the requirements of the specifications and drawings, so that fully satisfactory components will be supplied to the using services; secondly, that production must be accomplished in the minimum number of operations possible, using the highest rate production equipment available in the machine-tool and press manufacturers' art. It often has been said that in war the cost of a satisfactory item of equipment for troops is strictly secondary to quality in importance. With this we agree; but of primary importance is the length of time required to set up a shop fully equipped to produce such an item and the production time required per unit after production is begun. We will not always have someone else to hold the line until we can bring the full force of our armament to bear; therefore, simplification and increase in rate of production have as an important corollary *early supply to the troops*. Again, all Ordnance equipment must be made with this primary controlling factor: certainty of performance in the hands of our troops in the field.

Necessarily a balance must be struck between this excellence of performance and the ability to produce in a minimum of time. It seems to require no argument to prove that it is better to have a large quantity of weapons 90 per cent perfect, than to have a 10 per cent supply of weapons 100 per cent perfect. I often wonder how many of us know of the endless compromises arrived at between engineering and production in the manufacture of a motor car. We all do know, however, of the excellent performance it attains.

A ROUND of ammunition consists of many different components; of these, Frankford Arsenal manufactures the shell, the mechanical time fuze, the cartridge case, and the primer. In an article on "Artillery Ammunition Production" which appeared in the March-April 1939 issue of ARMY ORDNANCE (Vol. XIX, No. 113, p. 273), I attempted to show that due regard had been given to, and a high degree of success met with in, the simplification of the shell component of the complete round. This simplification has resulted in arriving at specifications and designs which will greatly increase production in time of an emergency and, as a corollary, reduce costs. Coincidentally with carrying on these endeavors as regards shell, the Ordnance Department has been actively and vigorously engaged in similar efforts as regards the design and manufacture of the other items comprising the complete round. This discussion will present developments relating to improved production methods, having as objectives reduction of the time required to reach mass production, reduced demands on number of artisans required, and lessened costs.

Fortunately, this country is blessed with a practically unlimited supply of copper which is used in such large quantities in the manufacture of cartridge cases. Thus, supply of raw material is not in any degree a critical one. We also have many large mills adequately equipped to supply in a minimum of time the necessary cartridge-brass discs for the fabrication of the case. The function of a cartridge case is to hold the propellent charge of powder and, upon the gun being fired, to obturate or prevent the escape of gases through the breech of the gun.

In obturating, the case expands outwardly against the walls of the chamber and if of proper dimensions and degree of hardness effectively seals off the gases from escape to the rear causing their full propulsive effort to be exerted upon the base of the projectile, thus uniformly imparting the necessary energy. Immediately after firing the case must contract to its normal dimensions so that it may be extracted readily from the gun. Over many years it has been found that brass of the composition which we use, with the induced degree of hardness imparted through manufacturing operations, is admirably suited to these purposes.

At this point it may be well to describe the manufacturing processes met with in the production of a typical case for the

*In charge of the artillery ammunition department, Frankford Arsenal, Philadelphia, Pa. Lieutenant Colonel, Ordnance Department, U. S. Army.
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75-mm. field gun, and also to show, by means of tables, the equipment required to produce a limited number of such cases per 8-hour day. The tables, we believe, will be of particular interest as indicating the time required to prepare a manufacturing set-up after production is required. (See Tables 1 and 2 on this and next page.)

In Fig. 1 are shown the disc which we purchase from commercial sources; the cup, which is the first forming of the disc; the three stages of drawing; the trimmed case body; the headed case; the tapered case, and the finished machined head of the completed article. The disc, which we have found to be most satisfactory, is known as cartridge brass, and has a composition of 70 per cent copper and 30 per cent zinc. The

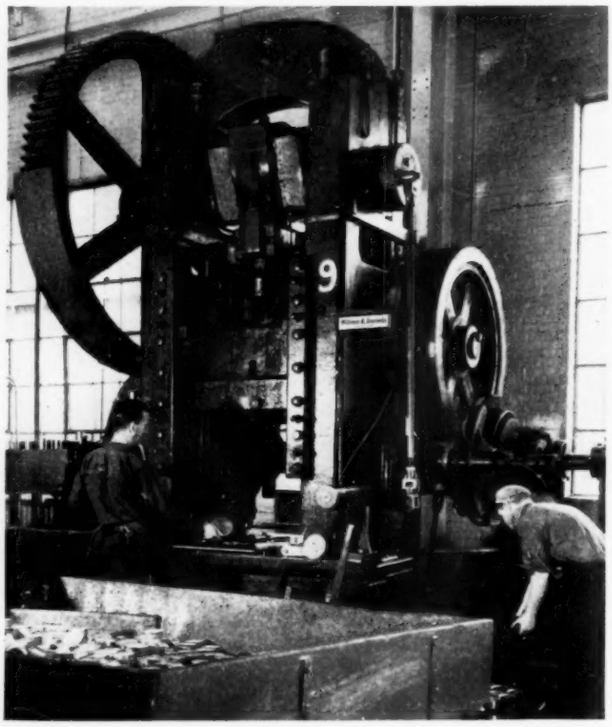

FIG. 2. CUPPING THE DISC ON A BLISS 225-TON PRESS

dimensions for the particular case under consideration are: diameter, 5.415–0.010 inches; thickness, 0.45–0.010-inch, and a weight of approximately 3 pounds 2 ounces. Most careful inspection is given this material to make certain there are no cracks, seams, or other flaws. Should such imperfections fail of detection, we will find, in subsequent operations, that they have been carried through, resulting in a rejected case, thus losing not only material, but expended labor as well.

THE manufacture of cartridge cases is very heavy repetitive work, and the reaction on the presses engaged in the operations is most severe. For this reason, and because we operate a job shop making a wide range of sizes, most of our presses are over-

TABLE NO. 1. 75-MM. FIELD GUN CARTRIDGE CASE

*(Production based on 3,750 cartridge cases per eight-hour day.)*

| *Oper. No.* | *Operation* | *Machine* | *Machines Required* | *Operators Required* | *Helpers Required* | *Weight per Unit Machine (Pounds)** | *Weight of Machines Required (Pounds)** | *Cost per Unit Machine *** | *Cost of Machines Required *** |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Cup | Bliss crank | .61 | .61 | .61 | 52,000 | 31,720 | $9,000 | $5,490 |
| 2 | 1st anneal and cool | Tate-Jones | 1.9 | 1.9 | 5.7 | 50,000 | 95,000 | 8,500 | 16,200 |
| 3 | 1st pickle & wash | Baskets | .62 | .62 | .... | 150 | 93 | 107 | 67 |
| | | Wooden tanks | 2.48 | .... | .... | 350 | 875 | 90 | 223 |
| 4 | 1st draw | Bliss hydro-dynamic | .72 | .72 | .72 | 25,400 | 18,300 | 15,500 | 11,160 |
| 5 | 2nd anneal & cool | Tate-Jones | 2.2 | 2.2 | 6.6 | 50,000 | 111,000 | 8,500 | 18,700 |
| 6 | 2nd pickle & wash | Baskets | .72 | .72 | .... | 150 | 108 | 107 | 77 |
| | | Wooden tanks | 2.88 | .... | .... | 350 | 1,000 | 90 | 259 |
| 7 | 2nd draw & wash | Bliss hydro-dynamic | .94 | .94 | .94 | 25,100 | 23,600 | 16,000 | 15,040 |
| 8 | 3rd anneal & cool | Tate-Jones | 2.8 | 2.8 | 8.4 | 50,000 | 140,000 | 8,500 | 23,800 |
| 9 | 3rd pickle & wash | Baskets | .87 | .87 | .... | 150 | 130 | 107 | 93 |
| | | Wooden tanks | 3.48 | .... | .... | 350 | 1,220 | 90 | 313 |
| 10 | 3rd draw & wash | Bliss hydro-dynamic | 1.0 | 1.0 | 1.0 | 27,800 | 27,800 | 16,500 | 16,500 |
| 11 | Trim | V. & O. | .37 | .37 | .37 | 3,000 | 1,100 | 5,530 | 2,050 |
| 12 | Head & indent | Hydraulic press | 1.0 | 1.0 | 2.0 | 88,500 | 88,500 | 28,870 | 28,870 |
| 13 | Anneal for taper | R. S. products | 1.0 | 1.0 | 2.0 | 4,300 | 4,300 | 1,000 | 1,000 |
| 14 | Taper | Ferracute | 1.0 | 1.0 | 1.0 | 6,500 | 6,500 | 7,400 | 7,400 |
| 15 | Finish head | Bullard | 1.56 | 1.56 | .... | 24,000 | 37,440 | 23,800 | 37,130 |
| 16 | Final trim | 2-spindle drill press | 1.56 | 1.56 | .... | 400 | 624 | 1,500 | 2,320 |
| 17 | Wash | Wooden tanks | 3.75 | 1.25 | .... | 300 | 1,100 | 75 | 281 |
| 18 | Mouth anneal & wash | R. S. products | 1.48 | 1.48 | .... | 4,300 | 6,364 | 1,000 | 1,480 |
| | | Wooden tanks | 4.44 | .... | 2.96 | 300 | 1,330 | 75 | 333 |
| 19 | Low temp. anneal | Surface combustion | 1.88 | 1.88 | .... | 25,000 | 47,000 | 9,650 | 18,142 |
| 20 | Stamp | Ferracute | .60 | .60 | .... | 6,100 | 3,660 | 6,300 | 3,780 |
| | TOTAL... | ..... | 39.86 | 24.08 | 32.30 | 444,500 | 648,764 | $168,291 | $210,708 |

*Weight includes weight of motor and all equipment excluding weight of dies and punches.

**Prices as of 1938. Floor space required: (3,750 shells per 8-hour day) exclusive of inspection and packing—10,500 sq. ft.

rated for the particular operations in which they are engaged. The presses thus are available for the manufacture of larger cases than that being described. However, we have found this to be a very advantageous set-up, in that we consequently have fewer breakdowns to throw the production lines out of balance. Our shop is in no sense of the word a mass-production shop, but within the recent past we have installed modern, high-production equipment, which safely may be taken as a model. When properly augmented our practice will facilitate mass production by such commercial concerns as may take up this line of munitions manufacture.

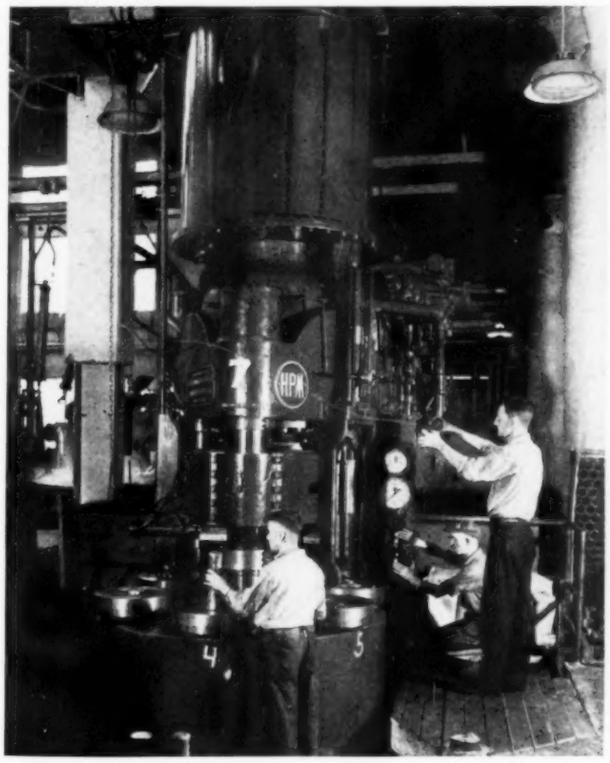


FIG. 3. HEADING THE CASE ON AN H.P.M. 1,000-TON PRESS

The first operation, known as cupping, is performed on a 225-ton Bliss mechanical press, shown in Fig. 2. The operation actually requires 125 tons' capacity. This operation completes the first forming of the disc. Enormous working strains have been set up which we relieve with an anneal at 1,150 degrees Fahrenheit. After annealing, the work is cooled by a shower spray of water which results in an excellent grain structure. The disc is then pickled in a five per cent sulphuric-acid solution to remove scale. The acid is in turn removed by a thorough wash and rinse to prevent future season cracking. We often are asked why we do not use a bright anneal and thus eliminate the pickle. The answer is that we have found the slight residual carbon deposit acts as a necessary lubricant in the subsequent drawing operation.

We use a 150-ton Toledo mechanical press for the first draw. This operation actually requires something less than seventy-five tons' pressure. By this draw the thickness of the wall of the cup is reduced from 0.2-inch to 0.093-inch and the length of the wall is increased from approximately 2.5 inches to 4.75 inches. We must anneal again to remove drawing strains, and the same pickle and wash as described above are given. The second draw, which requires something less than 35 tons' pressure, is performed on a 150-ton Bliss hydraulic press. This draw reduces the wall thickness to 0.043-inch and increases the length to approximately 8.875 inches. The usual anneal, pickle, and wash follow.

The third and final draw is performed on a 50-ton Bliss hydraulic press; the wall is reduced in thickness to 0.032-inch, and the length is increased to approximately 16 inches. For this operation approximately twenty tons' pressure is required.

Again, in all operations we advise the use of presses having a generous margin between rated capacity and actual working-load requirements. The small increase in initial cost will be returned many fold.

Fig. 4 shows a high-production V. & O. special trimmer made to our specifications. This machine is used to trim approximately 1½ inches from the open end of the case to remove the most highly stressed metal which is found at this point. The machine is equipped with a hopper feed,

TABLE NO. 2. 75-MM. FIELD GUN CARTRIDGE CASE

*(Production based on 3,750 cartridge cases per 8-hour day.)*

| *Oper. No.* | *Operation* | *Fixture* | *No. per Machine* | *No. of Machines* | *Number Required* | *Unit Weight* | *Required Weight* | *Unit Cost* | *Required Cost* |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Cup | Punch | 1 | .61 | .61 | 20.5 | 12.5 | $62.50 | $38.10 |
| | | Die | 1 | .61 | .61 | 33.5 | 20.4 | 60.00 | 36.60 |
| 4 | 1st draw | Punch | 1 | .72 | .72 | 23 | 16.5 | 62.50 | 45.00 |
| | | Die | 1 | .72 | .72 | 33.5 | 24.1 | 49.00 | 35.30 |
| 7 | 2nd draw | Punch | 1 | .94 | .94 | 30 | 27.2 | 65.00 | 61.00 |
| | | Die | 1 | .94 | .94 | 20 | 18.8 | 49.00 | 46.00 |
| 10 | 3rd draw | Punch | 1 | 1.0 | 1.0 | 47.5 | 47.5 | 72.00 | 72.00 |
| | | Die | 1 | 1.0 | 1.0 | 20 | 20 | 49.00 | 49.00 |
| 12 | Heading & indent | Post | 6 | 1.0 | 6.0 | 148 | 888 | 240.00 | 1,440.00 |
| | | Die | 6 | 1.0 | 6.0 | 29.5 | 177 | 44.00 | 264.00 |
| 14 | Taper | Die | 6 | 1.0 | 6.0 | 62.5 | 375 | 136.75 | 820.40 |
| | TOTAL... | ..... | 26 | 9.54 | 24.54 | 468.0 | 1,627.00 | $889.75 | $2,907.40 |

| | |
|---|---|
| COST OF MACHINES REQUIRED | 210,708.00 |
| TOTAL COST (Machines, punches, and dies) | $213,615.40 |

an arbor to hold the case, and a circular trimming cutter.

During all the preceding operations the dies used are so designed as to leave an excess of metal of crescent shape in the closed end or base of the cylinder. This excess metal is employed in forming the head of the case which is done by a 1,000-ton H.P.M. dial-feed press. The operation requires

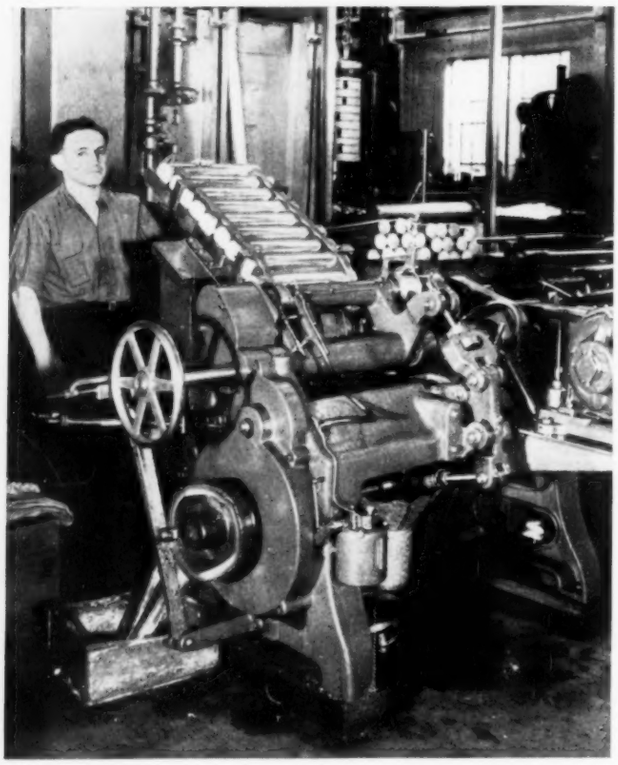

FIG. 4. TRIMMING THE CASE ON A V. & O. SPECIAL TRIMMER

some 675 tons' pressure. The press is shown in Fig. 3. From Fig. 1 it will be noted that we have formed a flat base having a sufficient lip or flange to engage the extractor of the gun for ejecting the case after firing. In heading the case, with one application of power we simultaneously not only form the head but also form a boss in the interior of the head of the case with an indentation. The metal of the boss, at this point, is thus additionally cold-worked to secure the maximum hardness within the limits of the metal. Such hardness is required to provide a primer seat which will assure maximum life against blowback of the powder gases around the primer within the head of the case when the complete round of ammunition is fired in the gun.

The case now is made ready for tapering. We first must guard against the possibility of cracking at the mouth end and in the body during the process by giving a special anneal to the body of the case. This anneal is applied to within approximately four inches of the head for two minutes in a saltpeter bath having a temperature of 950 degrees Fahrenheit. This we find removes all strains and softens the mouth and neck. During the firing of the cartridge case the metal is worked and becomes hardened. If too many rounds are fired between annealing and resizing, longitudinal splitting at the neck or mouth follows.

After the annealing operation we taper the case and form the mouth by means of the dial-feed Ferracute tapering press shown in Fig. 5. The mouth is necked down to the approximate diameter of the shell which is to be fitted therein and crimped thereto. The head of the case then is completely machined by means of a high-production multispindle machine. These machining operations consist in boring, counterboring and reaming the primer hole, facing the head of the case, and turning it to the required diameter and thickness of the extraction lip. We employ five tools for the total of five operations. The case next is trimmed to exact length in a high-production trimming machine. A thorough washing removes all oil and other foreign substances.

All information pertaining to the size, model, lot number, etc., now is stamped on the base. The mouth, to a height of two inches, is annealed in a saltpeter bath for two minutes to provide softer metal for crimping. The case is thoroughly washed again and a most meticulous inspection given to make sure of compliance with drawing dimension and character of finish. Throughout manufacture, continuous checks for grain structure and hardness are carried on in the laboratory.

We have found over a number of years that cartridge cases stored for long periods of time have developed season cracks, with consequent loss of the case. Therefore, at this point of manufacture we introduce a low-temperature anneal for a period of fifty minutes. Such a heat is not sufficient to affect the hardness or grain structure of the metal in the case but does relieve all residual strains incident to manufacturing and drawing operations. The furnace used for this anneal is a belt-type continuous furnace supplied by the Surface Combustion Corporation, and for smaller cases we have a box-type furnace of the same manufacture.

The packers now place twenty-five cases in a cardboard carton, which is stored until such time as five samples, representing a lot sent to the Aberdeen Proving Ground, have been accepted for proper performance. This functioning test consists in using a case during the firing of five rounds. After each firing, except the last, the case is resized. If obturation and functioning of the case are satisfactory and meet specification requirements, the entire lot is released and shipment is made to the loading plants. During the World War few, if any, cartridge cases were reloaded—as transportation back was not available. Too much stress cannot be laid upon the laboratory control mentioned above, if losses in drawing operations and subsequent firings are to be avoided. Experience tells us what grain structure is best suited for the purpose in hand, and we find that wherever this is present we have acceptable cases.

WE look upon our job as being one in which we must carry the torch of development and improvement in manufacturing technique. We cannot expect industry, which has no commercial market for cartridge cases, to do so. Our function, as we see it, should be to strive constantly to improve quality, to improve and reduce the number of manufacturing operations required, and above all, to give, when required, such advice and assistance to industry as is possible from our experience in this manufacture. Equally, we must assist in evolving a design of case which can be produced most readily in quantity in a minimum of time.

As an illustration, within the past year we have introduced the use of carbide dies into our drawing operations. Such use has improved the quality of the finish of our case and we have obtained an enormously increased die life. The first cost is relatively high, but the fact that the die life is so

much improved, with consequent less down time for changing and regrinding dies, offsets the added expenditure many times over. The load on the tool room is reduced correspondingly. One of the most serious situations to contemplate in time of a major effort is the acute shortage of skilled tool and die makers which will be encountered. Hence, any manufacturing set-up which lightens the demand for tools and dies is a real contribution.

The punches used in cartridge-case manufacture are from tool steel, which is supplied by a number of high-grade manufacturers. We also are constantly striving to increase the speed in feet per minute on all drawing operations. This we are able to do by improved design of dies and by our variable-speed presses. Very great strides, of course, have been made in the past few years in the matter of press design. We find the modern hydraulic press so constructed that the nonproductive part of the stroke cycle is very rapid, usually one hundred feet or more per minute. Thus, over a fixed and uniform speed of stroke, such as is met with in an old-style press, much time is saved and production is increased. We are using drawing speeds of twenty-five feet per minute for some of our drawing operations, and for certain others find it possible to go as high as thirty-five feet per minute.

Again, by proper design of dies and redistribution of volume of metal flow between draws, fortunately we have been able to reduce the number of draws required during manufacture of a case. In a major emergency this is of very real importance in reducing the demand for presses, annealing furnaces, and other equipment required. Operators and set-up men are thus released for other useful work. If the older method required six draws, and we have been able to reduce this figure to three, we have, by the same token, reduced the equipment and operators required by one-half. The demand on the press and equipment manufacturers is lessened, and production can be entered upon in a correspondingly lessened period of time. Certain metals have been offered to us from which we have made a number of experimental cases and have found that but one anneal was required during the drawing operations. This again would lighten the furnace and pickling requirements.

Our handling of the task here should be, after all, no different from that of any other aggressive, forward-looking organization. The problem should be faced as one demanding a correct solution in terms of simplification and reduction of operations required. Above all, it should be our aim constantly to improve quality of production, and to evolve better production designs. In our judgment, no article of ordnance equipment should incorporate a single refinement not required for proper functioning. This must be accepted as axiomatic by all who have control of design and production. How often are our "problems" self-made!

WHEN we contemplate in detail the amount of equipment required for the manufacture of a small number of cases, in the light of production requirements in time of emergency, the problem assumes, to put it mildly, large proportions. It is, of course, well known that we carry but small war-reserve stocks of ammunition and its components and that we must depend upon our efforts after the beginning of an emergency to meet the demands of our field forces. Do not let us fall into an attitude of complacency, look back to the World War, and say that at the time of the Armistice we were producing in excess of the requirements of this and that. We may not always be able to depend upon foreign sources of supply.

We, who are daily engaged in the manufacture of cartridge cases in our small production laboratory, as we call it, are ever seeking to find means for an early supply of these cases when required. Can we manufacture the required quantities of cases of present design in the limited time which may be

FIG. 5. TAPERING THE CASE ON FERRACUTE DIAL FEED PRESS

available? Will we be prepared to face an emergency? What can we do to simplify and reduce the number of manufacturing operations? Should the design be changed in part or radically? Are we faced with like questions in other ordnance efforts? Should not we all in our various lines of endeavor take stock and ask ourselves these things?

The answers to some of these questions may be found in the developments in which we now are engaged. These include a cartridge case composed of brass tubing suitably secured to a brass base; a case of steel tubing suitably secured to a steel base; a case of molded plastic, and a case of plywood.

Simplification of design in the interest of production and early production in the interest of our national safety—perhaps of our very survival—should be ever uppermost in the minds of all connected with armament for our national defense. Let production and more production be our goal.

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EDITOR'S NOTE.—Closely allied to the above article and of similar importance is the discussion by the same author published in the March-April 1939 issue of this journal (Vol. XIX, No. 113, p. 273). In that article, entitled "Artillery Ammunition Production," Colonel Campbell described the methods and practices which are followed at the Frankford Arsenal in the manufacture of projectiles. His paper has created considerable comment. (See the letter to the editor on page 257 of this issue.) It is hoped that the above article also will lead to similar constructive discussion in these pages.

# ARMY ORDNANCE

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## *Month by Month*

THE METHOD AND ALTERNATIVES OF OUR military armament preparedness today are quite plain. Heretofore we have groped and stumbled in our search for a military policy. Now the alternatives are obvious, their implications are clear, their responsibilities known, their costs predictable. It remains only for the American people through their accredited representatives to make the choice. For any one of three alternatives is before us.

We can (1) arm—as we are doing—an Initial Protective Force of half a million men; or (2) we can provide the arms for a Protective Mobilization Force of one million men; or (3) we can provide some of the armament for a force larger than either of the former depending upon the military mission entailed by whatever national policy we adopt in the present emergency. Whichever course we follow there is this consolation—we can approach our national-defense job in a way which differs radically from our traditional approach. By deciding what the task shall be and arming to meet that task we are following a procedure of taking first things first. Our usual conduct in such cases has been to put the cart before the horse!

If it is decided that our national policy shall rest upon the Initial Protective Force of half a million men, then our degree of preparedness soon will be quite sufficient. In man power we will have the necessary numbers in the combined Regular Army and National Guard. These forces require more training especially in large units—a need which recent maneuvers have served to emphasize and to correct. This force has some modern equipment, some is being produced, and funds are available to complete deficiencies in various categories. If the Initial Protective Force is to be the limit of our military effort, then one might view the national-defense scene with complacency and some degree of sufficiency. But it is a fanciful wish to conclude that so small a force, no matter how well trained and well equipped, is adequate to the needs of hemisphere defense and all its implications.

If it be our national policy—and there are indications pointing to the fact that the American people are of such a mind—that we and our sister nations of the Western Hemisphere shall regard the defense of our joint possessions as a common obligation, then our military policy must accept and provide for the Protective Mobilization Force. This force is double the size of the initial force. While it does not contemplate the recruitment of personnel on active service to the number of a million men, it does very definitely connote the armament equipment for such numbers. It is to be hoped that as the estimates in the coming session of Congress are disclosed they will show clearly the need for having the equipment for such a force *in being in the storehouses*. For a protective force both in name and in nature must be ready for the larger responsibilities of hemisphere defense. Thus two World War lessons promptly stand out. The one is that we can train men at a much faster rate than we can build armament. The other is that the time factor of armament production being the controlling element, it will make little difference how quickly we recruit our man power if the weapons of defense are not available for their use.

Whatever larger forces may be required is problematical. Surely, from the layman's point of view, our Army will have experienced a vast change for the better if it is staffed and equipped for hemisphere defense. Its future responsibilities would be lightened by such preparedness. The job ahead seems to be hemisphere defense and nothing less.

Any of these forms of defense policy can be translated directly in terms of money. Hence we have the alternatives first in degree of importance, next in degree of cost. If it should come to pass that the choice of policy continues to precede the choice of cost, then our defense forces will experience a decidedly and a completely effective procedure. However the decision is made, it will be a wise decision if it is based upon the job to be done—let the cost be secondary.

THE WAR DEPARTMENT, AND ESPECIALLY THE Office of the Assistant Secretary of War, are to be commended upon the progress made in the development of new forms of war-time contracts. A series of simple agreements which would be used in time of war or when war is imminent has been drawn up after years of study by the various supply branches and planning officials. In this work industry itself has frequently been sought for counsel and advice.

The principal form of agreement is a unit-price contract based on a definite cost price per unit. This would be the most common form, of course. Should the price prove to be unfair after the contract is completed, the contractor may negotiate with the chief of the branch concerned if the amount is less than $15,000. If the estimated loss on the part of the manufacturer is greater than $15,000 he may arbitrate the matter. In any event, this type of contract will have application to those supplies for which previous contracts, over long periods of manufacture by Army plants, have provided a unit-cost measure. A second type of contract would be used where the unit cost of an item is unknown because of lack of previous manufacturing experience. In the case of heavy artillery, for instance, it might be impossible to estimate the cost of manufacturing any given amount in quantity because previous experience may have related only to pilot models or small lots. In such a case, the number of

units to be produced would be specified, and after work progressed sufficiently to provide a basis for determining unit cost, the cost would be set. This is in effect an adaptation of the British "target contract" so effectively used in the early stages of the current British armament program and as fully described in these columns.

These new forms—representing tremendous study over many years—deserve a sympathetic attitude on the part of all concerned. Their presentation at this juncture is most appropriate. It is only fair to assume that in time of major emergency unit-price contracts with protective clauses will be used wherever it is humanly possible to do so. The supplementary types will be used to meet emergency conditions. If there seem to be extraordinary provisions in any of them, these are included as much for the protection of the contractor as for the protection of the Government.

INDUSTRIAL PREPAREDNESS EXPERIENCED A most helpful clinical study in recent months at the hands of the War Resources Board. Obviously, the plans and policies of the War and Navy Departments are all the better for the survey conducted by Edward R. Stettinius, Jr., and his associates of the Board.

In order that the record may be complete and the high praise which the Board received from the President of the United States may be part of that record, we quote the following from the President's letter to the chairman of the War Resources Board written during November 1939 upon completion of the Board's study:

"Early in August, with my approval, the War Resources Board was established to advise with the Army and Navy Munitions Board in reviewing and completing the industrial-mobilization plan prepared by that agency, specifically for use only in the event of a major war.

"In the intervening weeks you and your associates on this board of review have devoted much time and effort to the task assigned you and now have submitted the comprehensive report which has just been placed before me. This report will be carefully studied. I feel certain it will prove of material assistance in perfecting our plans for the national defense. I have noted and heartily concur with the concluding paragraph of your report which reads as follows:

" 'In submitting this report the Board feels that it has rendered the principal service for which it was appointed. So long as the United States is not engaged in war, such a board has no power and no executive responsibility. We feel that such preparedness plans as are deemed necessary should be carried forward under the auspices of the Army and Navy Munitions Board with the coöperation of other departments of Government.

" 'However, if it is desired that we continue to meet from time to time in an advisory relationship with the Army and Navy Munitions Board, we shall, of course, be happy to serve in that capacity.'

"At this time I should like to express to you personally my appreciation of the fine spirit with which you undertook this important public service, and for the constructive work which you have performed. Your patriotic offer of further service is also greatly appreciated and I hope that you will continue to act in an advisory capacity to the Army and Navy Munitions Board, as it may request from time to time."

PUBLICATION OF THE LATEST REVISED TEXT of the Industrial Mobilization Plan created a laughable situation among journalists who seemed to regard it with hypercritical eyes. The gentlemen of the press went to great pains first to say that the Industrial Mobilization Plan is a secret or confidential document. The truth of the matter is that the plan is not secret or confidential, that previous editions have been on sale by the Superintendent of Documents, U. S. Government Printing Office, at fifteen cents a copy. Slant-minded writers further attempted to portray the plan in its latest revision as another step toward dictatorship, or at least toward regimentation of industry, management, and labor in time of war. Again the plan contains no such provisions—any more than are by nature implied in the very term "mobilization." To mobilize means to put in a state of readiness for active service in war. If the mobilization is to be industrial then it must be planned to apply to the entire economic power of the country. Some columnists are making cheap capital when they attempt to read into plans for the effective use of American resources in war any steps which would abrogate the fundamental natural or constitutional rights of any American citizen or institution.

The 1939 revision of the plan goes to particular pains on its very first page to stress these points. In its foreword the plan says: "The Industrial Mobilization Plan, as its name implies, is a study. It is a guide to be available in time of major war. It would apply only for the duration of such a war. It attempts to anticipate the difficulties experienced by the United States during the World War. It aims to overcome such difficulties promptly and effectively in any future war in which our country unfortunately may become engaged. This plan does not propose the modification of any of our constitutional processes. Indeed the prime purpose of procurement planning and of the Industrial Mobilization Plan is the protection and continuation of these processes which are so basic to the peace and security of the people of the United States."

In the face of this, what is one to conclude when he finds segments of the daily press generously reading into the plan provisions which it does not contain? For instance, the *Detroit Free Press,* in its issues of November 28 and 29, 1939, made these glaring (and we hope unintentional) misstatements of fact regarding the plan: "All problems between employer and employee would be handled through the War Labor Administration, composed of Army and Navy officers." Had the writer bothered to examine the plan he would find Army and Navy officers cast in no such war-time rôle. "For all practical purposes," the article continues, "the Army and the Navy would direct all functions of the Board (*i.e.,* War Resources) including the regulation of labor." Absurd! But the most ludicrous type of misinterpretation, however, remains for the following statement by the *Free Press:* "For the plants providing materials of war, labor would be conscripted in the same manner as would the men in the armed services."

It is regrettable that journalism of this type in an influential daily paper should so far disregard plain truth. For it is a distinct disservice to our country to misrepresent and misinterpret the intentions of our military and naval authorities, and it is a far more serious thing thus to poison the popular mind about the coöperative measures which might have to be adopted should the United States ever again be forced to mobilize for a major war.

# *The Decisive Battles*

## An Editorial

MAJ. GEN. J. F. C. FULLER, renowned British soldier and author, is especially well known to readers of ARMY ORDNANCE. His analyses of military problems, fortified by a striking style, keen logic, and deep scholarship, have appeared frequently in these pages. His writings during the past twenty years embrace two score and more of books, many of which will have a lasting effect on military thought throughout the world for years to come.

General Fuller's latest contribution to the literature of warfare has just come from the press. A 2-volume work, it is "The Decisive Battles—Their Influence upon History and Civilization." Volume I comprises the period from Alexander the Great (B.C. 331) to Frederick the Great (1757). Volume II, to be issued shortly, embraces the period from Napoleon I (1763) to Marshal Pilsudski (1920). The English edition is published by Eyre and Spottiswoode. An American edition will be published this year by Charles Scribner's Sons. The two volumes combined contain more than a thousand pages. Each battle is amply illustrated by diagrams of unusual clarity.

Three characteristics distinguish "The Decisive Battles" from run-of-the-mine military history. These same characteristics enhance the value of the work and forecast its endurance. The first of these characteristics is deep scholarship; the second is clear analysis; the third, unique timeliness. Any of these qualities would be sufficient to mark as exceptional a military book written by a qualified military historian at this treacherous period in the world's history. The three combined under the genius of General Fuller attest the inherent value of this work for the military and civilian reader alike in a day when *Blitzkrieg* and other shibboleths are taking their toll of historical accuracy.

The standard text in the English language on the world's great battles which has been a guide for nearly eighty years is Sir Edward Creasy's "Fifteen Decisive Battles of the World from Marathon to Waterloo," published in 1851. Since Creasy there has been no comprehensive and authoritative text on the same subject nor—and this is most important—has there been a deep study of *decisive* engagements. True enough, there have been piecemeal studies of campaigns incident to wars or series of wars; there have been studies of the engagements of a particular period; there have been volumes on the strategy and tactics of great commanders in all the battles in which this or that leader participated. But there has not been a new Creasy until now. As General Fuller, on the basis of scholarship, steps into this rôle and replaces a text which has held the stage for three quarters of a century, he does so bearing every desired credential. His handiwork bids fair to be a standard text, unchallenged for generations to come.

The author divides his vast survey into three principal parts. The first he calls the Alexandrian or Thallasic period (B.C. 336 to A.D. 1453). The second is the Columbian or Oceanic period (1454 to 1763). The third is the Napoleonic or Continental period (1763 to 1920). Parts 1 and 2 constitute Volume I; part 3 constitutes Volume II. Serious exception can and will be taken to General Fuller's catalogue of decisive battles. He has chosen twenty-nine of them. Historians may challenge specific parts of the selection; that is to say, they may differ from the author's choice. But none will challenge successfully the analysis of the actions selected. For General Fuller, conforming to his established scholarship, has consulted more than 1,000 first-rate authorities. He cites chapter and verse for salient historical facts.

This type of scholarship applied to the history of warfare is a boon to a sorely troubled world which had all but forgotten the military art and which suddenly has come to realize its permanence and depth. No finer service could have been performed by an author of General Fuller's attainments than to present his treatise at this particular time. The world—military and civilian—needs it and its lessons sadly.

FEW military historians are qualified to question General Fuller's method of analysis because few have surveyed the vast field of military history as thoroughly as he. What he writes about ancient battles is known, in general terms, to all readers of the Greek and Latin classics. Coming closer to home, his views of decisive battles in American history carry conviction. For of the twenty-nine battles in world history which he considers worthy of the attribute "decisive," two were fought in North America—the Siege of Quebec and Battle of the Plains of Abraham, 1759, and the Battle of Chattanooga, 1863. The author has added to the analytic quality of his text by inserting a synopsis of the period intervening between each battle described.

These and other characteristics combine to make General Fuller's latest work the most timely of any that has come from his pen. His facts have a ring to them which military and lay students had best study now or rue the day. Differ with him as one may about the applications of mechanization to warfare and other minor matters—the type of question military students have debated from the beginning of time and will debate to the end—no sane person in the year 1940 will contest the truth and wisdom of his appraisal of warfare in the affairs of men. General Fuller holds, as do all non-emotional people, that a deep and impartial knowledge of history is essential if one is to understand present world conditions and the probable causes and origins of future wars. Therefore "unless the people as a whole have some understanding of what war meant in past ages, their opinions on war as it faces us today will be purely alchemical."

The soldier wil' find hours of most profitable study within the covers of these two volumes. It is to be hoped that a large segment of our now military minded civilians will share the same profitable experience. If there is one uncontestable point which General Fuller proves it is this: The civilian mind can ill afford to neglect the experience and method of the great military leaders of the past. Their strategy, tactics, leadership and determination have left an indelible mark on humanity's path toward more enduring peace, and the civilian mind must now, of all times, make certain that such leadership will be provided and followed if decisive battles are yet to come. A careful study of General Fuller's volumes will be of inestimable value at this very moment to a bewildered world which is groping for enlightenment as to the cause and conduct of a just war. Here it will be found. L.A.C.

# Association Affairs

### CHICAGO POST

MAJ. GEN. C. M. WESSON, Chief of Ordnance of the Army, and Brig. Gen. Charles G. Dawes, former Vice-President of the United States and a member of the Chicago Ordnance District Advisory Board, were the principal speakers at a gala dinner meeting of the Chicago Post, Army Ordnance Association, held at the Palmer House, Chicago, on the evening of November 6, 1939. General Wesson spoke on "Military Armament Preparedness." General Dawes stressed the rôle of industry in national defense. C. B. Cole, president, Chicago Chapter, American Society of Tool Engineers, spoke on the steps that should be taken to develop tools and tool makers for a defense program. Edmund A. Russell, distinguished leader of the Ordnance forces in Chicago during the past twenty years, presided and introduced the speakers. More than 300 members and guests were in attendance—the largest gathering in the history of the Chicago Post.

Other guests and members who were seated at the speakers' table and who were presented by the toastmaster were: Lieut. Gen. Stanley H. Ford, U. S. Army, commanding general, Second Army; Brig. Gen. Robert E. Wood, advisory board, Chicago Ordnance District; Fred. A. Preston, chief, Chicago Ordnance District; Col. C. B. Thummel, Ord. Dept., Ordnance officer, Sixth Corps Area; C. C. Austin, chairman, manufacturing section, American Society of Mechanical Engineers; Sterling Morton, director, Chicago Post, Army Ordnance Association; Maj. J. De N. Macomb, American Society of Civil Engineers; Homer D. Sayre, commissioner, National Metal Trades Association; Col. Robert G. Peck, U. S. Army, Ret.; Col. Virgil L. Peterson, chief of staff, Sixth Corps Area; Maj. Francis W. Parker, Jr., Ord Res., vice-president, Chicago Post, Army Ordnance Association; Dr. William L. Abbott, Western Society of Engineers; Lieut. Col. L. A. Codd, Ord. Res., executive secretary, Army Ordnance Association; H. H. Gilbert, Pullman Standard Car Manufacturing Company; Lieut. Col. J. L. Homer, C.A.C.; Col. Donald Armstrong, Ord. Dept., executive officer, Chicago Ordnance District; and W. Homer Hartz, president, Illinois Manufacturers Association. Pertinent excerpts from General Wesson's address follow:

"Defense preparedness is today a question constantly in the mind of every responsible citizen. Any steps toward that end, it seems to me, must be considered in their relation to our national policy. What is that policy? Certainly I profess no qualifications to speak with authority on the nation's policy, but as regards this and the current objectives under this policy—there are certain facts which are of common knowledge. Let us consider these briefly.

"We may safely say that the Monroe Doctrine on the one hand and the iron resolve of the people of this country to avoid European entanglements on the other hand form the basis of our national policy. A national policy of any kind is utterly fatuous unless the nation is prepared to enforce it against all comers if and when an attempt should be made on the part of others to violate it. Hence, a policy of necessity must generate enforcement plans. These plans, we take it, are also accepted by the nation, including the means—both personnel and matériel—to carry them out.

"In furtherance of these concepts of national policy, our country demands for itself a Navy, not only second to none, but one that can reckon with any probable combination of aggressors in the waters that wash our shores.

"As for the Army, the national policy is expressed in the National Defense Act of 1920. This act provides for a small Regular Army and National Guard for continental defense and for certain troops for our insular possessions. It contemplates that this force will be augmented in time of necessity through the medium of our Organized Reserves. The personnel provisions of the National Defense Act are comprehensive. But, as regards the matériel, that is, the arms, ammunition, and other forms of munitions, the National Defense Act is mostly negative. It does provide for industrial-mobilization plans. It also provides that no matériel will be declared surplus, except in cases where the amounts are sufficient for an army of a million men. This provision offers no basis for securing new and improved types of matériel. It merely forces us to keep on hand a stated minimum amount of old matériel.

"My remarks on the peace-time procedure of placing Government contracts are not made in a spirit of criticism. The methods employed are based on law. They are designed for the protection of the Government and to guarantee open and free competition. In connection with the subject of making contracts, conditions are now developing which have a strong influence on industrial enterprise. These are rising material prices, shortage in skilled labor, long-time machine-tool deliveries, possible wage increases, profit limitation on certain types of armament, which provision requires that the basis of amortization of special equipment required by such orders has to be established before a contractor is on sound ground to tender a bid. Government financing of certain orders is being suggested. These factors are tending to complicate the procurement problem further. Prospective contractors are evidencing distrust of long-term commitments in the absence of protective guarantees against these uncertainties. This protection, which is afforded under contracts made under emergency conditions, cannot be legally provided under our peace-time methods. If these conditions become more acute, and we become committed to a larger rearmament program, some cognizance must be taken of them; otherwise, we may encounter almost insurmountable difficulties in placing contracts for certain items."

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### MILWAUKEE POST

UNDER the leadership of Col. William W. Coleman, president of the Milwaukee Post and a vice-president of the Army Ordnance Association, the largest number of members and guests in the history of the Post attended the annual dinner November 7, 1939. The guest of honor was Maj. Gen. C. M. Wesson, Chief of Ordnance, U. S. Army. The meeting was held in the banquet hall of the Pfister Hotel. Two hundred and thirty-seven members and guests attended. Colonel Coleman presided.

Taking as his theme the military armament needed for a "Protective Mobilization Force," General Wesson emphasized the requirements in time and matériel for such an undertaking. On this point he said:

"I have discussed some of the mechanics—now let us get to principles. The combined strength of the Regular Army and the National Guard is known as the 'Initial Protective Force.' This force we are now undertaking to provide with essential items of equipment and with sufficient reserves to maintain it in action until industry can produce matériel for consumption and wastage factors. The Initial Protective Force should be ready to take the field without delay. It is the spearhead or covering force of that larger force which will have to be raised and equipped in the event of a major emergency.

"If and when a major emergency should arise, we could quickly recruit a larger force. These newly raised units when amalgamated with the trained units of the Regular Army and National Guard could be brought to a fair degree of efficiency in comparatively few months. These units would be of little avail without the implements and supplies necessary to equip

them and sustain them as a fighting force. Men can be recruited and trained far more quickly than their weapons can be produced, and without the weapons of defense men are truly cannon fodder.

"Will our country be content with this situation when it knows the facts? The next logical step in armament preparedness would be to provide the equipment and reserves for that larger army, which is called the "Protective Mobilization Force." This force consists of the Regular Army, the National Guard brought to war strength, with the addition of certain specialized units. This force would consist of 700,000 men in the organized units and 300,000 in the Reserves. For a nation as great as ours, with so much at stake, with our responsibility and our advantages, the contemplation of producing equipment for such a modest force would, I believe, meet with general approval. *Remember that it will take two years to provide the additional equipment for such a force, should its services ever be required.* The few hundred million dollars necessary is a small premium for a very large amount of insurance.

"Procurement planning is all important. To appreciate the importance of this work we must examine the underlying doctrine of supply. The requirements for an army in the field are made up of three factors: initial equipment, predicted wastage, and consumption factors. Military requirements are expressed by an ascending curve, which reaches its maximum when all the troops in the military plan are in the theater of operations. From these requirements we may deduct any equipment we have on hand. The resultant curve indicates the quantity and rate of delivery that must be obtained from industry. Procurement planning is emphasized by the National Defense Act. If munitions ordinarily were produced commercially and were available at the corner store in the amounts desired, there would be no occasion for procurement planning. Unfortunately, this is not the case. We must, therefore, list our deficiencies in war matériel, place them before industry, determine which plants are best fitted to produce them, develop a system by which plants are allocated to the production of a specific item, have these plants work out production schedules, and go just as far as possible, short of making a definite contract, so that in the event of an emergency a minimum time will be consumed in getting under way."

Lieut. Col. L. A. Codd, Ord. Res., executive secretary of the Army Ordnance Association, also addressed the meeting on the present status of the organization.

Seated at the speakers' table with General Wesson, Colonel Coleman and Colonel Codd were Col. N. F. Ramsey, commanding officer, Rock Island Arsenal; C. Raymond Messinger, assistant chief of the Milwaukee Ordnance District; Col. Donald Armstrong, executive officer, Chicago Ordnance District; Harold S. Falk, Col. Stephen A. Park, J. E. DeLong, Lieut. Col. E. H. Lichtenberg, Maj. R. S. Hoar, F. R. Bacon, Herbert Kohler, and Lieut. C. W. Laumann. Messrs. Lichtenberg, Hoar, DeLong, Falk, Kohler, and Bacon are directors of the Milwaukee Post. Lieutenant Laumann is secretary-treasurer of the Post and one of its charter members.

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## NEW MEMBERS

DURING the period October 1 to November 30, 1939, inclusive, the following applicants were admitted to membership in the Army Ordnance Association: Warren W. Ache, Hellertown, Pa.; Everett G. Ackart, Wilmington, Del.; John Allegaert, Newark, N. J.; S. C. Allyn, Dayton, Ohio; John D. Armitage, Aberdeen Proving Ground, Md.; Henry C. Ashley, Watertown, Conn.

C. E. Barber, Boston, Mass.; George E. Bass, Bridgeton, N. J.; Harry C. Bayless, Chicago, Ill.; G. W. Beals, Meriden, Conn.; Edwin H. Bechtel, Los Angeles, Calif.; R. A. Beckwith, Milwaukee, Wis.; Albion Bindley, Pittsburgh, Pa.; Frederick S. Blackall, Jr., Woonsocket, R. I.; W. E. Blank, Dayton, Ohio; Harold L. Blood, Worcester, Mass.; William G. Bond, Holly Oak, Del.; W. G. Boswell, Dayton, Ohio; Donald L. Bower, Washington, D. C.; John V. Bowser, Wilmerding, Pa.; George K. Bradfield, Jr., Hackensack, N. J.; E. E. Bradway, Winnetka, Ill.; Stanley A. Brandenburg, Hartford, Conn.; E. R. Bridgewater, Wilmington, Del.; Andrew H. Brown, New York, N. Y.; James P. Brown, Philadelphia, Pa.; Norman S. Brown, St. Louis, Mo.; E. A. Brugger, Newton, Iowa; Graham Brush, Jr., Cambridge, Mass.; George F. Bryant, Chicago, Ill.; William F. Burchfield, New York, N. Y.; Richard Burns, Worcester, Mass.; C. T. Butler, Wilmington, Del.; Robert W. Buzzard, Kensington, Md.; Laud S. Byers, Manila, P. I.

R. Caemmerer, Bethlehem, Pa.; Robert W. Cairns, Wilmington, Del.; A. F. Campbell, Washington, D. C.; John W. Campbell, Greensburg, Pa.; Joseph P. Carney, Worcester, Mass.; David B. Carson, Youngstown, Ohio; C. H. Carter, Jr., Tamaqua, Pa.; Milo M. Case, Monterey Park, Calif.; Clarence P. Chamberlin, Detroit, Mich.; E. Corbin Chapman, Chattanooga, Tenn.; A. W. Chauncey, New York, N. Y.; Ralph Cheli, Bethlehem, Pa.; Tom C. Clark, Warrenton, Mo.; Robert O. Cleveland, Grand Rapids, Mich.; Paul Coddington, Milwaukee, Wis.; Roy E. Cole, South Bend, Ind.; Thomas E. Coleman, Madison, Wis.; W. L. Collins, Creve Coeur, Mo.; Oakes M. Colwell, Bethlehem, Pa.; John W. Converse, Philadelphia, Pa.; Robert Conway, New York, N. Y.; Willard M. Cook, Bridgeton, N. J.; George Coopey, Bethlehem, Pa.; Robert C. Corlett, Chicago, Ill.; John A. Courter, Caldwell, N. J.; William H. Courtright, Philadelphia, Pa.; James G. Cowling, Washington, D. C.; R. T. Crane, New York, N. Y.; Willard deC. Crater, Newark, Del.; W. R. Csellak, Bethlehem, Pa.

William W. Dancy, Glendale, Mo.; Clark W. Davis, Swarthmore, Pa.; James P. Davis, Champaign, Ill.; Merlin L. DeGuire, Watertown, Mass.; Philip DeHuff, Jr., Lebanon, Pa.; Frank A. Donaldson, St. Paul, Minn.; James F. Dowd, Plainfield, N. J.; G. Fred Driemeyer, St. Louis, Mo.; Raymond W. Dull, La-Grange, Ill.; Roy F. Durham, Warrenton, Mo.

Donald Eadie, Bethlehem, Pa.; W. S. Edgar, Bound Brook, N. J.; Carl Ekdahl, Worcester, Mass.; Cecil D. Engel, St. Louis, Mo.; Robert C. Engle, Bethlehem, Pa.; Ralph O. Ensign, Milwaukee, Wis.

Gustave Fassin, Ann Arbor, Mich.; W. J. Feigley, Quakertown, Pa.; Robert I. Felch, Bethlehem, Pa.; Irving M. Felt, New York, N. Y.; Valentine W. Fernekes, Warrenton, Mo.; William L. Fink, Oakmont, Pa.; Roger S. Firestone, Providence, R. I.; G. R. Fitterer, Pittsburgh, Pa.; John B. Fitzpatrick, New York, N. Y.; George C. Floyd, Leechburg, Pa.; Edward P. Foeller, Kirkwood, Mo.; Samuel W. Fordyce, St. Louis, Mo.; Charles W. Forline, Clayton, Mo.; Albert C. Foss, Jr., Bethlehem, Pa.; Louis F. Fow, Hightstown, N. J.; Gerald B. Fox, Troy, Ohio; A. S. Fredrickson, Milwaukee, Wis.; Walter B. French, Lowell, Mass.; Granville B. Fuller, Brighton, Mass.

William H. Gamble, York, Pa.; Eugene J. Gartland, Richmond Heights, Mo.; P. Gazaniga, Meriden, Conn.; George C. Gerner, Meriden, Conn.; James P. Gillilan, Bristol, Conn.; Howard G. Glass, Baltimore, Md.; Alwin A. Gloetzner, Washington, D. C.; John R. Godman, Washington, D. C.; M. J. Graham, Chicago, Ill.; Eugene Grasselli, Wilmington, Del.; C. A. Green, Dayton, Ohio; M. Greiveldinger, Port Washington, Wis.; John P. Griffin, Erie, Pa.; George A. Grille, Jr., Washington, D. C.; Robert S. Grubmeyer, Bethlehem, Pa.; William R. Grunow, Tarentum, Pa.

Herbert T. Hackbarth, Meriden, Conn.; Edward R. Hall, Towson, Md.; Hollis P. Halladay, Birmingham, Mich.; H. B. Hambleton, Washington, D. C.; Robert A. Hardesty, North Hornell, N. Y.; C. L. Harrell, St. Louis, Mo.; Harry E. Harris, Bridgeport, Conn.; F. James Harrold, Bethlehem, Pa.; William Hartman, Dayton, Ohio; Lawrence W. Hayden, New York, N. Y.; F. H. Heine, Milwaukee, Wis.; H. J. Hemingway, New

York, N. Y.; Edward D. Herrick, Williamsport, Pa.; Robert F. Herrick, Jr., Boston, Mass.; Edwin Hodge, Jr., Pittsburgh, Pa.; W. K. Hodson, Bethlehem, Pa.; P. John Hoener, Webster Groves, Mo.; C. T. Hoffman, Watertown, Conn.; Frank X. Hohn, St. Louis, Mo.; A. E. Holcomb, Milwaukee, Wis.; Foster Holmes, St. Louis, Mo.; John F. Houck, Fort Wayne, Ind.; George H. Houston, New York, N. Y.; Albert W. Howe, Poughkeepsie, N. Y.; Harvey W. Howe, Los Angeles, Calif.; Ralph S. Howe, New Britain, Conn.; M. Fred Hubbell, Glendale, Mo.; Houlder Hudgins, New York, N. Y.; Harry A. Husted, St. Clair, Mich.; Cecil M. Hyde, Connersville, Ind.; R. H. Jack, New York, N. Y.; C. S. Johnson, Champaign, Ill.; Lyman C. Josephs, Jr., Allentown, Pa.

S. S. Kahn, New York, N. Y.; C. F. Kalmbach, Bethlehem, Pa.; A. M. Karwacki, Bethlehem, Pa.; Edward C. Kavanagh, New York, N. Y.; R. C. Kelly, Bethlehem, Pa.; Ralph B. Kennett, Newark, N. J.; Thomas R. Kerschner, Fort Bliss, Tex.; Gordon F. Keyes, Salem, Ohio; Johnston Kingsley, New York, N. Y.; Thomas Kingsley, St. Louis, Mo.; Paul K. Klaesius, Baltimore, Md.; Raymond F. Koch, Brookline, Mass.; W. J. Koehring, Milwaukee, Wis.; Robert F. Koenig, Long Island City, N. Y.; Fred Kornet, Jr., Bethlehem, Pa.; Alfred S. Kos, Avon Lake, Ohio; Charles E. Kuhn, Brooklyn, N. Y.; Ivan C. Kuhns, Narberth, Pa.

William H. Larkin, St. Louis, Mo.; Harry Lauterbach, Burlingame, Calif.; A. W. Lavers, Minneapolis, Minn.; A. E. Lee, Bethlehem, Pa.; Thomas G. Lewis, Warthen, Ga.; G. Burton Liese, New York, N. Y.; C. F. Lincoln, Jr., Philadelphia, Pa.; Thayer Lindsley, New York, N. Y.; Ellis C. Littman, Clayton, Mo.; Edgar Littmann, St. Louis, Mo.; W. Spencer Lloyd, Pittsburgh, Pa.; Albert I. Lodwick, New York, N. Y.; David Lofts, Chicago, Ill.; G. R. Lohnes, Dayton, Ohio; T. L. Loose, Worcester, Mass.; Harry T. Loynd, Brackenridge, Pa.; Charles H. Luby, Philadelphia, Pa.

D. W. MacFeeters, Bethlehem, Pa.; William G. Mackenzie, New York, N. Y.; R. E. Malinowski, Hellertown, Pa.; Rudolph E. Malmberg, Washington, Pa.; Walter A. Manss, Wilmington, Del.; Earl R. Marble, Jr., Tacoma, Wash.; L. K. Marshall, Cambridge, Mass.; Charles B. Martell, San Pedro, Calif.; R. S. Marthens, Pittsburgh, Pa.; John H. Mathewson, Elkins Park, Pa.; Ralph H. Matthiessen, New York, N. Y.; Charles B. McCoy, Wilmington, Del.; Merle E. McCoy, Coraopolis, Pa.; James L. McGehee, Watertown, Mass.; Edgar M. McGinnis, Kings Mills, Ohio; T. H. McGraw, Braeburn, Pa.; F. F. McIntosh, Sewickley, Pa.; Philip M. McKenna, Latrobe, Pa.; L. J. McKinley, Bethlehem, Pa.; Arnold R. McLain, Chattanooga, Tenn.; Morton McMichael, Ruxton, Md.; W. B. McMillan, St. Louis, Mo.; David S. McNally, West Roxbury, Mass.; Roger J. McNamara, Bethlehem, Pa.; Lloyd C. McNeill, Lynchburg, Va.; L. G. Meads, New York, N. Y.; David A. Meeker, Troy, Ohio; Robert J. Meier, Boston, Mass.; C. T. Melvin, Newark, N. J.; Walter J. Mervis, Pittsburgh, Pa.; George F. Messinger, Bethlehem, Pa.; C. W. Meyers, Cleveland, Ohio; Frank J. Miller, Chicago, Ill.; G. Niles Miller, Philadelphia, Pa.; W. F. Minor, Meriden, Conn.; William T. Monroe, Irvington, N. J.; Herbert R. Moody, West Roxbury, Mass.; David P. Moore, Pittsburgh, Pa.; Charles J. Morrello, New York, N. Y.; Edward W. Morris, St. Louis Co., Mo.; F. Hughes Moyer, Pittsburgh, Pa.; R. N. Mulliken, Wilmington, Del.; Francis B. Mulvaney, Chicago, Ill.; Kenneth B. Murdoch, Newark, N. J.

Frederick W. Nadig, Allentown, Pa.; H. D. Newell, Beaver Falls, Pa.; John B. Neyman, Pittsburgh, Pa. E. J. O'Donnell, San Pedro, Calif.; G. L. Omon, Milwaukee, Wis.; Alan Osbourne, Washington, D. C.; Ralph E. Otis, Jr., Mishawaka, Ind.

Joseph R. Patterson, Beaver, Pa.; Ward S. Patterson, Chappaqua, N. Y.; Helmuth Pedersen, Warrenton, Mo.; Arthur R. Peel, Waterbury, Conn.; John V. Pennington, Houston, Tex.; Raymond S. Pettibone, Island Heights, N. J.; D. S. Phelan, St. Louis, Mo.; William J. Phelan, City of La Due, Mo.; Edward Phillips, Bethlehem, Pa.; Harry H. Pinney, Shaker Heights, Ohio; E. W. Pittman, New York, N. Y.; Gardiner S. Platt, Washington, D. C.; John W. Poteet, Jr., Baltimore, Md.; Norman L. Preusch, Philadelphia, Pa.

Schrade F. Radtke, Cambridge, Mass.; Martin H. Ray, New York, N. Y.; Wallace J. Ray, Rye, N. Y.; John E. Raymer, Jr.; Bethlehem, Pa.; Hudson W. Reed, Philadelphia, Pa.; David J. Richards, Pittsburgh, Pa.; David J. Richards, Jr., South Bend, Ind.; James H. Richards, Pittsburgh, Pa.; Stanley A. Richardson, Cleveland, Ohio; John B. Richey, Bloomfield, N. J.; Frank R. Ridgley, Rochester, N. Y.; Joseph A. Riggs, Chicago, Ill.; Carl L. Roberts, Wood River, Ill.; Gilbert M. Roddy, Boston, Mass.; Edgar J. Rodgers, Scranton, Pa.; M. Samuel Rosenthal, Baltimore, Md.; Elmer E. Ross, San Leandro, Calif.; Al P. Rowan, St. Louis, Mo.; E. Harold Ruehle, Newark, N. J.; Robert Ruhl, Kirkwood, Mo.; L. R. Russell, Milwaukee, Wis.

Everit J. Sadler, New York, N. Y.; Robert C. Sahlin, Parkesburg, Pa.; J. Q. Salisbury, Dayton, Ohio; Clarence B. Sawyer, Brookline, Mass.; Frederic Schaefer, Pittsburgh, Pa.; Wilbur J. Schindler, Rock Island, Ill.; William R. Schneider, Ellicott City, Md.; Harry A. Schnitzer, Lancaster, Pa.; John C. Schreiner, Lyman, Neb.; Walter M. Schweder, Trenton, N. J.; Walter H. Shanessy, Brooklyn, N. Y.; Edward M. Sharp, Bethlehem, Pa.; Richard M. Shepherd, Bethlehem, Pa.; Henry H. Silliman, Wilmington, Del.; Charles A. Singuefield, Norris, Tenn.; George L. Skirm, Washington, D. C.; Fred Slagle, Meriden, Conn.; C. H. Slater, Baltimore, Md.; E. D. Smith, Dayton, Ohio; W. Earl Smith, Rochester, N. Y.; J. L. K. Snyder, Cranford, N. J.; John I. Spangler, York, Pa.; L. B. Sperry, Chicago, Ill.; Charles M. Squarcy, East Chicago, Ind.; Albert B. Stambach, Lock Haven, Pa.; W. E. Stark, E. Cleveland, Ohio; I. K. Stearns, Bryson City, N. C.; Emil H. Stein, Indianapolis, Ind.; Gerald R. Stewart, Chicago, Ill.; Charles J. Stilwell, Cleveland, Ohio; Charles H. Stonerod, Longmeadow, Mass.; Frank J. Storm, Boston, Mass.; E. E. Storms, Dayton, Ohio; Samuel Strumer, New York, N. Y.; Robert Stubbings, Bethlehem, Pa.; James D. Sullivan, Denver, Colo.; Edwin V. Sumner, Cambridge, Mass.; Richard U. Surbeck, Ridgewood, N. J.; Joel W. Swindells, Pearl River, N. Y.; Donald C. Switzer, Hornell, N. Y.; Arthur E. Szabo, Jr., Brooklyn, N. Y.

Granville M. Taliaferro, Dover, N. J.; Lawrence E. Teich, Cambridge, Mass.; Ralph A. Teich, St. Louis, Mo.; J. W. Temple, Bethlehem, Pa.; Harold R. Thielecke, St. Louis County, Mo.; Alvah H. Thomas, Bethlehem, Pa.; Harold B. Thomas, Bloomfield, N. J.; Hulme W. Thomas, Allentown, Pa.; Norman T. Thomas, Jr., Cambridge, Mass.; Ernest E. Thum, Cleveland, Ohio; George H. Tilson, Rosebank, S. I., N. Y.; Van Winkle Todd, Matawan, N. J.; E. J. Tompkins, Cincinnati, Ohio; John K. Tope, Washington, D. C.; Leonard J. Travis, LaGrange, Ill.; B. G. Tremaine, Jr., Meriden, Conn.; Norman K. Turnbull, Philadelphia, Pa.; Harold B. Tyree, Grosse Point, Mich.

C. S. Vanderblue, Worcester, Mass.; George O. Van Orden, Metuchen, N. J.; J. W. Viner, New York, N. Y.; Walter Vogelsberg, Bethlehem, Pa.

L. E. Walsh, River Forest, Ill.; W. H. Ward, Wilmington, Del.; Stowell C. Wasson, Indianapolis, Ind.; G. Neville Waters, Gettysburg, Pa.; Harold B. Weidman, Lititz, Pa.; Edwin A. Weinberg, Troy, N. Y.; L. P. Weiner, Peoria, Ill.; S. K. Wellman, Cleveland, Ohio; H. G. Werner, Bethlehem, Pa.; L. W. Whaley, Wilmington, Del.; Norman F. Whalley, Fall River, Mass.; John G. Wheale, Fairfield, Conn.; Clinton J. White, Worcester, Mass.; Edward D. F. Whitehead, Washington, D. C.; A. M. Wickwire, Jr., Garfield, N. J.; H. M. Williams, Dayton, Ohio; Staunton Williams, Hartford, Conn.; George P. Witteman, Bethlehem, Pa.; Edward F. Wohlers, Sr., St. Albans, L. I., N. Y.; Edson L. Wood, Springfield, Mass.; William Wrigley, Bethlehem, Pa.; E. B. Yancey, Wilmington, Del.; Karl H. Zornig, Bethlehem, Pa.

### NECROLOGY

CHESTER CASTLE BOLTON, member of Congress from the 22nd Congressional District of Ohio and a leading figure in the development of a sound national defense, died at his home in Cleveland, October 29, 1939. His loss to the Army is very great. Congressman Bolton had given during many years a brilliant degree of service begun at Plattsburg in 1916 and continued on the staff of the first War Industries Board and of the Assistant Secretary of War in 1917.

Congressman Bolton was particularly close to the Ordnance problem. Identified with that stalwart band under the leadership of Newton D. Baker, who evolved from nothing our vast war machine in 1917-1918, Chester Bolton had that quiet, cultured good judgment of men and of policies the effects of which are written deep in the record of those days. His was that all-too-rare statesmanship which shunned the spectacular.

Following his war service at headquarters in Washington, he became a field officer and rose to the rank of colonel as an assistant chief of staff of the 101st Division. Later, he served in the Ohio Legislature where he participated in noteworthy reforms of the Ohio tax structure. In 1928 he was elected to Congress to succeed the great Theodore E. Burton, "but he was of such caliber that this important district never noticed the change." During his service as a member of the Appropriations Committee, he was particularly concerned about matériel preparedness; when the current rearmament program was undertaken two years ago he was one of its leading exponents. For this latest of his great services, the Army and the country owe him added gratitude.

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LIEUT. COL. AIKEN SIMONS, M. I. RES., a charter member of the Army Ordnance Association, died suddenly at Florence, S. C., November 28, 1939. His death removes from the Ordnance fraternity one who was well known and admired in war and peace. A native of Charleston, S. C., Colonel Simons had resided there since his retirement from active business five years ago. He fulfilled the long tradition of culture, learning, and affability which were his by inheritance. During the World War, as a captain in the 26th Division in France, he became an aide to Maj. Gen. Johnson Hagood, Chief of the Service of Supply. Colonel Simons' father had served in a similar capacity under Brig. Gen. Johnson Hagood, C. S. A.

A student at The Citadel, Charleston, and an engineering graduate of Lehigh University, Colonel Simons, prior to the World War and following it, was associated with E. I. du Pont de Nemours & Company. His knowledge of military explosives and propellent powders was most comprehensive. His services to the Army, particularly to the Ordnance Department, in connection with its powder and explosives developments, were of inestimable and lasting worth.

Colonel Simons was a frequent contributor to the pages of this journal. An authoritative writer on powder and ballistics, he was a connoisseur of antique arms. In the passing of this valiant member, ARMY ORDNANCE records with sorrow the loss of one who gave generously of his time and talents to the national defense of his country. In him were combined in generous measure the traditions of the civilian soldier whose concept of duty was no less deep in time of peace than it was in days of active service in the armed forces.

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NOTICE also has been received of the death of the following members of the Association: Henry Allen, Muskegon Heights, Mich.; J. B. D. Edge, Kennett Square, Pa.; A. L. Humphrey, Wilmerding, Pa.; Victor T. Price, Cincinnati, Ohio; W. C. Stevens, Milwaukee, Wis.; M. H. Thompson, New York, N. Y. To their relatives and friends ARMY ORDNANCE, on behalf of the Association membership, extends condolences.

## *Professional Digest*

*The following abstracts are based on current periodicals and events and aim to present a wide range of facts and opinions regarding recent developments of professional military interest. Quotation marks are omitted but sources are indicated.*

A QUICK SURVEY OF THE INFANTRY ORGANIZATION of the conflicting European armies, compiled from information translated from foreign military journals, reveals the following approximate infantry organizations.

Available information, compiled before the complete mobilization and before numerous special military bodies were inducted into the German Army, divided the German Army into 18 army corps, with 43 divisions, four of which are fast motorized units with many tanks and armored cars. It is estimated that the peace-time strength of a German division is 15,000 men, which would be doubled in time of war. In addition to the above, the German Army had five armored divisions, each of two regiments of 200 tanks apiece, giving an organized tank strength of 2,000.

In Great Britain, the Secretary of War, Hore Belisha, in his last annual report, declared that motorization in the British infantry has progressed to a point where all the ammunition and equipment and half the total personnel of all thirteen divisions of the British Field Army can be carried at one time.

Of the thirteen infantry divisions, four are regular and nine are Territorial (National Guard) troops. In peace time, the battalion organization provides a strength of three hundred rifles, forty-five Bren machine guns, thirty-six 2-inch mortars, four 3-inch mortars and twelve antitank guns. The organization provides for three platoons to a company, the platoons composed of three sections of eight men each. Sections are armed with rifles and one Bren gun. Nine of the heavy Bren guns attached to the battalion are carried on low-silhouette armored caterpillar carriers with a 3-man crew. These vehicles are sometimes referred to as "tankettes." Infantry formation is in columns of threes, similar to the newly adopted infantry drill regulations of the American Army. The basic infantry truck is described as a ¾-ton vehicle capable of transporting seven men with full personnel equipment. A motorcycle has been developed, chiefly for the use of the Territorials, which carries three men and a Bren machine gun. Driving on both rear wheels, the machine is said to be capable of traveling over very rough terrain. Supporting forces include antitank regiments. These regiments, equipped with 2-pounder (40-mm. or 1.58-inch) antitank guns, form an important part of the force. The guns have an all-around traverse, high rate of fire, and are said to be capable of penetrations of as much as 1½ inches at ranges up to 1000 yards. These guns are truck-drawn and the regiment is organized into a headquarters battery and 4 firing batteries of 3 platoons of 4 guns each, giving a total of 48 guns to a regiment. Antitank mines and Dannert "concertina" wire also are used in antitank tactics. Antiaircraft weapons supporting infantry operations are Bren machine guns, on antiaircraft mounts, 40-mm. Bofors guns, and 3-inch, 3.7-inch and 4.5-inch guns. The latter fire only from a stationary position. The Bren and Bofors guns are employed against low-flying aircraft, while the heavier weapons are designed to defend against high-altitude bombers.

Light and cruiser (medium) tanks are employed as supporting elements, but little detail is available immediately on the disposition of these weapons. The recent conflicts in China, Spain, Ethiopia, and other parts of the world have upset some of the British theories of tank employment.

The French have the three battalions to a regiment organization common to most armies. With the complete mobilization of the French Army it is impossible to determine organizational set-up. However, in any organization, one of the chief features will be the concentration of fire power in heavy weapons. The regiment, in peace time, has an "accompanying company" of nine 25-mm. antitank guns and two 81-mm. mortars. Each of the three battalions has a similar supporting company, and these companies have four machine-gun platoons (sixteen guns), a mortar group (two 81-mm. mortars) and a 37-mm. gun.

AT THIS WRITING, THE NEW "STREAMLINED" Infantry division which has been under development at Fort Sam Houston, Tex., consists of the following: A division commander and his staff—the latter paralleling the War Department general and technical staff; a division headquarters company; three infantry regiments, each with 115 officers and 2426 enlisted men, which gives them about two-thirds the strength of the World War regiments; three Field Artillery gun battalions, each with 20 officers and 396 enlisted men; two Field Artillery howitzer battalions, each with 14 officers and 326 enlisted men; one Engineer battalion, with 15 officers and 393 enlisted men; one Medical battalion, with 22 officers and 429 enlisted men; one Quartermaster battalion, with 15 officers and 299 enlisted men; one Military Police company, with 4 officers and 104 enlisted men; and one Signal company, with 8 officers and 202 enlisted men.

This assembly of organizations places the strength of the new proposed division at about 28,000 officers and men. It is estimated that with the new Infantry weapons allocated to the foot troops, together with the strong artillery echelon, the streamlined division will have about twice the fire power of the present division. Mechanization and motorization gives it a mobility many fold greater than that of the present organization. It will be noted that there apparently is no place for brigadier generals, for there is no brigade organization in the set-up of either the Infantry organization or the artillery echelon. The division commander exercises supervision over the operations of each of the three Infantry regiments and the five artillery battalions.

With the elimination of the brigade echelons, sweeping changes will necessarily have to be made in the general officer grades in both the Regular Army and the National Guard. Again, with the elimination of the regimental organization in the Field Artillery, the same type of changes will have to be effected in the field officer grades in both these components.

The heavy allocation of artillery provides the infantry regiments with strong artillery support in the attack and high protection in defensive operations. All this artillery is completely motorized and hence has a high degree of mobility.

BECAUSE OF THE RECENT EDUCATIONAL-ORDER appropriations, the Chemical Warfare Service will soon have at its disposal a gas-mask assembly plant larger than that at Edgewood Arsenal, Md., and capable of assembling 100,000 gas masks a month on one shift, or 300,000 masks on a 3-shift basis.

The plant will be located in a building belonging to the Goodyear Rubber Company, at Akron, Ohio, and for the most part will be situated on a single floor. Machinery and equipment for assembling the masks will be furnished by both the Government and Goodyear, and when the contract has been completed, will belong to the Government, but will probably be stored at Akron, according to the *Army and Navy Journal*.

The contract, which is to be completed May 4, 1940, calls for furnishing only 4000 gas masks and is not intended primarily to supply Government needs. The masks will be tested rigidly, however, and must be perfectly satisfactory to be accepted, since the Government considers that a plant capable of turning out 4000 or 100,000 masks is of no value unless the product, whatever the plant capacity, is satisfactory.

# *Ordnance Maintenance*

## THE 2ND ORDNANCE COMPANY GOES INTO MASS PRODUCTION

BY LIEUT. A. R. DEL CAMPO, ORD. DEPT.

IN describing to the readers of ARMY ORDNANCE this adventure of the 2nd Ordnance Company into the strange realm of mass production, one feels much as Robinson Crusoe would have felt had he been directed to describe his experiences in house building to the readers of the *Architectural Forum*. For this is not

THE M1 ARM RACK FOR THE SEMIAUTOMATIC RIFLE

an essay on mass production, but a narrative of the improvisation of a mass-production set-up in a repair shop by enlisted repair personnel.

To those older members of the Army Ordnance Association whose productive genius has so enriched this country, this article has nothing to offer except a heartfelt appreciation of the agonies of mass production.

On the other hand, there are younger members of the Association—Reserve officers just out of school. These are the men who in the next emergency might find themselves in command of just such a company as this. To those men this article will bring, it is hoped, a little additional confidence in meeting that emergency. For it is intended to publicize the stuff of which the American soldier is made.

Parenthetically, let it be stated that after eight years in the service the author has found it axiomatic that every group of American soldiers can meet every situation; that in each outfit will be found all the necessary qualities; and that no matter what necessary quality you yourself may lack, some of your soldiers will possess it, and see you through.

The 2nd Ordnance Company is part of the famous 2nd Division, stationed at Fort Sam Houston, San Antonio, Tex. As such, it is ready to take the field on three hours' notice, fully equipped to maintain the ordnance equipment of the division.

In garrison, the company occupies a fine little shop where it carries on the maintenance of ordnance in greater comfort. Essentially, the function of the company is to replace unservice-

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able parts and subassemblies, and to make minor repairs. Bigger jobs are supposed to be done by more rearward echelons, which are better equipped and have a larger working force.

In the summer of 1938, the first M1 rifles began to arrive for issue to the 2nd Division. It was at once apparent that the steel rack used to secure the 1903 Springfield would not hold these rifles. A letter to the Chief's office brought the reply: "Nothing yet available. Improvise locally." Thereupon began a flight into production and a departure from maintenance.

First, a pilot model was constructed. It was made of wood and steel, weighed 120 pounds (empty) and satisfied the management that it would secure the rifles and that the materials would cost less than $5 per rack. The pilot model was built from whole pieces of lumber and from scrap, from lumber begged and borrowed; from steel in stock, from steel we borrowed, and even from steel scraps welded together.

PRODUCTION of 150 racks was then ordered. One can hardly think of a worse quantity than 150. To an inexperienced mind, like mine, it was in that borderland—too large a number for job-lot methods, and too small a number for mass-production methods. The men were for attacking the problem at once by the job-lot method, for that was within their experience. However, the other method was adopted. This proved fortunate, because before the 150 racks were finished the order had been increased to 400 (130 for the rest of the 2nd Division at Fort Warren and 120 for certain National Guard regiments).

After the pilot model came the drawing. This took a long time. After all, there are many things a lieutenant has to do when he is post Ordnance property officer, assistant shop officer, and a lieutenant in the company. For this reason we made the jigs simultaneously with the drawing. And, adding heresy to heterodoxy, the jig drawings were freehand sketches on a scratch pad, with dimensions taken from the drawing. Of course it was risky business, particularly as changes persisted in suggesting themselves as the drawing progressed.

When a machinist finished a jig, he brought it in for a check. Then he was given a sketch for another jig. Often he contributed a suggestion which was quickly either accepted or rejected. Then he hurried out and set to work. By the time the drawing of the rack was finished, only two jigs had to be remade due to changes in the drawing. In this way about three weeks' time was gained.

One word about the jigs. They were based primarily on the shop machines. The shop is nicely equipped with the basic machine-tool equipment. We made our jigs very carefully (within our capabilities) primarily to insure accuracy of the product. Indirectly, of course, this speeded up production because it facilitated assembly and because the men didn't have to stop to make measurements. Finally, we were ready to test our jigs. This was done by making one rack, using the jigs. With some minor exceptions we found they worked. The exceptions were quickly remedied.

We now were ready to go ahead. The officers and section leaders went into a huddle to work out the manufacturing procedure. Boxes of varying lengths had been collected. A tag was placed on each box naming the piece it would contain and the route of the piece from the first machine used on it through to the assembly point. Sergeant Morse now took full charge of production which is described below.

In general, the steel parts were cut from 20-foot lengths by a metal power saw. From there they went to the milling machine or shaper where they were trimmed to fit the jigs. Thence they went in turn to the different drills and grinding wheels. Finally they came together at the rear of the shop where the steel frames were assembled by riveting and welding.

Fortunately we had sufficient drill presses so that each drill press could be assigned one, and only one, size of twist drill. By each drill press were kept the jigs for the required operations. When the steel frames for the day were completed they were

taken outside and painted by spray gun. When dry, they were brought to the center of the shop for final assembly.

THE wood parts were cut from 12-foot lengths in the carpenter shop. Here we had two ½-horsepower woodworking power saws, one our own and one borrowed. We extended the guide rods with brass rods fitted to them. The jigs used regulated the dado cuts effectively. The depth of the cut in the wood was obtained by raising the dado blades above the table until they touched the roof of the notch in the jig. The distance of the cut from the end of the piece of wood was regulated by setting the face of the notch against the side of the dado and then bringing the guide plate of the saw up to the jig.

Where the cuts were made in intervals (as for the notches at the top and bottom of the rack) we used spacer jigs on guide rods. These jigs were made from a pipe found on the scrap heap. This pipe had an interior diameter equal to the exterior diameter of the guide rods. The pipe was cut to lengths equal to the center-to-center distances of the required cuts (tolerances were 0.003-inch). Then these lengths were split in three pieces lengthwise.

When the dado and the guide plate had been set for the first cut described above, the necessary number of spacer jigs were placed on the guide rods, the first fitting snugly against the back of the guide plates, the others fitting snugly with each other. Finally all were held in place by collars.

The operator made the first notches in *all* the pieces of wood for a given production. He then removed the first pair of spacer jigs, and moved the guide plate back to fit snugly against the second pair of spacer jigs. He now made his second cuts in all the pieces of wood for the given production, and so on. When the wood pieces left the carpenter shop they went to the various drills and finally to the linseed-oil vat. Here each piece of wood was submerged for at least four hours, and often overnight or over the weekend.

After the soak, excess oil was removed, and the parts were sponged with a raw sienna mixture to intensify the grain. The wood parts then were assembled to the steel frames using space in the center of the shop. Next, the edges of the wood were rounded with the portable sander. Then all screws, nuts, bolts, etc., used in the assembly, were painted.

Finally, each rack was inspected filled with twenty rifles. If passed, the rack was stamped with the Ordnance inspection escutcheon, and taken to the warehouse for issue.

NOW all this time the company had a regular maintenance load to carry. In order not to fall too far behind in this maintenance, we called on the Infantry and received twelve men who bore half the burden of the rack production once it got going. They were used on the assembly.

From January 2nd to March 2nd we produced 255 racks, and had parts for 50 more racks ready for assembly. During this time, of course, we had the usual time out for military duties, such as inspections, special formations, and even one "call to arms," when the entire division was alerted for field service by the corps-area commander. As the men gained experience, both the quality and quantity of production increased. Toward the end of February, production averaged ten racks a day.

This conversion of a repair shop into a manufacturing plant using soldier labor, excited a great deal of interest. Generals and staff officers of corps and division, as well as line officers, visited the shop and were conducted through the manufacturing operations.

This business has been a real adventure. Soldiers love adventure and are always ready to "put out" when something important is in the air. The soldiers of the 2nd Ordnance Company and of the 9th and 23rd Infantry Regiments demonstrated that they could carry their objective in peace-time manufacture with the same *élan* that animated them on the battlefields of France.


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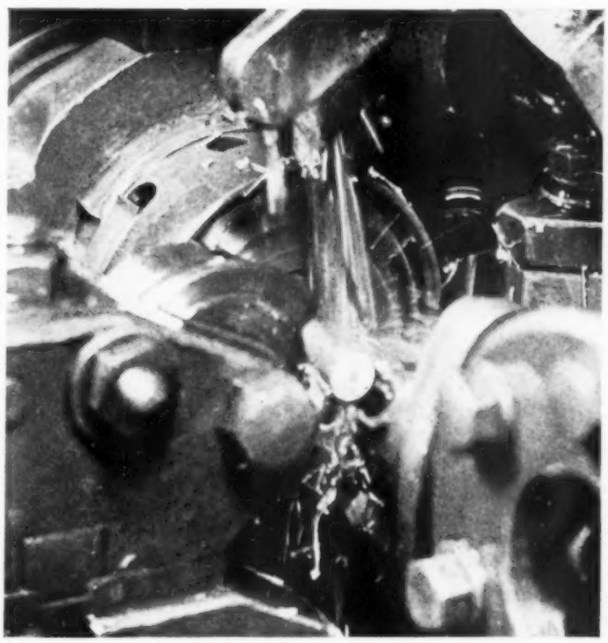

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## *Ordnance in Review*

### RECENT DEVELOPMENTS IN SPORTING ARMS, PART I

BY LIEUT. COL. CALVIN GODDARD, ORD. RES.

THIS department heretofore has been devoted almost exclusively to matters of ordnance history. But in the belief that the readers of ARMY ORDNANCE from time to time would appreciate descriptions of new and interesting developments in the field of arms and ammunition, sporting and military, "Ordnance in Review" in this and certain succeeding issues will be devoted to descriptions of various types of small arms and the ammunition for these, newly offered to the world. The historical element, however, will not be overlooked. The evolutionary factors which have contributed toward the development of models but recently released will receive full consideration whenever possible.

The adage about "nothing new under the sun" applies so forcibly in the sphere of small arms that no one familiar with the history of projectile weapons ever expects to see a really novel design come out of an assembly room. And the J. Stevens Arms Company (a division of the Savage Arms Corporation) makes no claim of novelty for its Model *22*-410 combination rifle and shotgun, just recently released to the sporting world. For the idea of one barrel placed atop another is almost as old as that of the gun itself. But one feature of the new weapon appears to combine the unusual with the extremely practical. This is the finger-controlled device whereby one of the two firing pins is selected to receive the blow of the single hammer.

Although the over-and-under type of weapon long has been known in this country and was quite popular with many sportsmen during both flint- and percussion-ignition periods, since the metallic cartridge became standard no American maker of renown appears to have engaged in the production of an arm combining a rifled and a smoothbored barrel of he-man size and weight, until the current year. True, the Marble Company with its "Game Getter" (introduced some time past, discontinued, and lately revived) offers a combination weapon embodying the same calibers as are represented in the current Stevens product. However it is a compromise piece, neither shoulder arm nor handgun, but a cross between the two, with pistol handle, very short barrels, and a skeleton stock which, when in place, permits firing from the shoulder.

APART from the Marble Company and their "Game Getter", survey of the market shows various over-and-under guns in which two *shotgun* barrels of identical gauge are combined, but none other wherein one bore is rifled and the other smooth, save in a recent release by Marlin. This differs from the Stevens product, however, in being hammerless and in carrying a price tag over three times the size of that adorning the latter. But it is available in heavier, and in the writer's opinion somewhat more desirable, calibers than is the Stevens.

Specifications of the *22*-410 obviously include a barrel (upper) of *.22* rim-fire caliber, chambered for the *.22* long-rifle cartridge, and another, (smooth-bored, and full-choked,) taking the .410-gauge shot shell in 3-inch case length. It likewise will handle the .44 X.L. shot cartridge, and the various .44-40 and .44 "Game Getter" shot loads as well.

The barrel length is *24* inches and the weight of the piece approximates 6 pounds. In the specimen examined, trigger pull proved to be 5¼ pounds—a satisfactory figure for a weapon of this character. The frame is case-hardened, the barrels blued, and the stock (designed with a pistol grip) nicely finished and topped off with a hard-rubber butt plate. A take-down feature

of conventional shotgun type is incorporated. Separate extractors serve the two barrels, the .22 extractor being actuated by a spring and the .410 by a cam.

Standard sights include a rear unit of the conventional sporting or "Rocky Mountain" variety with graduated step for elevation and a bead front of stainless steel flattened on top. Neither is very satisfactory. The notched step of the rear sight is so small and difficult to get at that setting it for a given elevation becomes a real chore. To attempt this maneuver in cold weather with chilled fingers or mittened hands would be to invite a ruined disposition. The front bead is of such generous diameter (⅛-inch) that it becomes impossible, with such a sighting combination, to develop the accuracy inherent in the .22 barrel, while the fixed and prominent rear sight probably disturbs the scattergun shooter whose experience has been gained over long years of using a front bead only.

In the writer's opinion, the rear sight should be supplanted by one whose base (fitting into the barrel slot) is of standard diameter so that it may be replaced with one of another type as the shooter wishes. The present base is only about 5/16-inch wide at the bottom, and the whole sight design appears to have been carried over almost bodily from some of the Stevens single-shot pistols of ancient vintage.

Next, the vertical element of the rear sight, in which the sighting notch is cut, should be hinged to the base extension of which it constitutes the terminal portion in such manner that when it is folded down and the elevating step removed, the contours of the top surface of the .22 barrel would be practically unbroken from breech to muzzle. The sighting notch should be reshaped. The front bead should be flattened on both sides and much reduced in thickness—the already flattened top surface being made flatter still. Its profile would thus become rectangular when viewed from the rear (like the conventional blade-type front sight), but its diameter along the axis of the bore would remain undiminished. In this position it would coördinate properly with the reshaped notch in the rear sight when the .22 barrel was to be employed. By remounting the bead so that it could be rotated through an arc of ninety degrees, the shotgun devotee could restore the spherical-bead profile in an instant by a twist of the fingers, obviating at the same time any disturbance of his aim due to the presence of the rifle-type rear sight by folding this down and removing the elevating step.

I have indicated that the caliber combination in which this piece is now produced might be improved upon. Others are of the same mind, it appears, for I understand the makers of the 22-410 already have had a host of suggestions as to other sizes in which it *should* be developed. Its present major drawback, in the writer's opinion, is the rather feeble killing power of the .410 shot barrel. Granted that it will handle—in the 3-inch case for which it is chambered—¾-ounce of shot or the equivalent of the standard load of a 28-gauge gun, the 14/100-inch greater bore diameter of the latter renders it immeasurably superior to the .410 in any contest between the two. Indeed the average sportsman relegates the .410 to the sphere of women and boys—and wisely so, in my humble opinion.

As to rifle calibers in which such an arm might be produced, providing these prove compatible with the present design of the piece, these include the .22 Winchester rim-fire, .25 Stevens, rim-fire, .22 Hornet, etc. It is possible that the extra "punch" inherent in the latest varieties of .22 Winchester rim-fire over the .22 long-rifle cartridge might warrant the chambering of a certain proportion of the output in that caliber. And if the .25 Stevens rim-fire ever comes out in the rejuvenated and superpowered form in which it has been expected to be issued for some years, it should prove an ideal answer to him who seeks a low-priced cartridge of accuracy approximating that of the .22 long-rifle, but with materially greater killing power.

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## *Communications*

### CIVILIAN AIR DEFENSE

THE EDITOR:

The slogan "No more wars" will never help any country. It is as foolish as the slogan "No more earthquakes" would be. War is a natural catastrophe, caused it is true, by the stupidity, the greed, and the wickedness of man, but as these characteristics appear to be component parts of the human nature, wars will be unavoidable as long as human beings live on this globe.

From the standpoint of the United States, it is immaterial as to who will fight whom, because in the end the United States will be attacked anyway; therefore, she must prepare now, in peace time, for any eventuality.

In a future war, the subjects most exposed to attack will not be the soldiers, but the civilians and the industrial plants, because an adversary will try to break the morale of and cause panic among the civilian population and interfere with the production of the war necessities.

The importance of doing everything possible to safeguard the lives of employees and workers does not need to be stressed, and any measures which can be taken to enable production to be maintained, especially for vital national services, will be of the utmost value to our country.

There is no question that our Army and Navy will do everything in their power to repulse an invader, but it must be borne in mind that even the mightiest military defense is not able to hinder completely an energetic and well-prepared enemy from carrying out aërial attacks.

In a future war there will be no difference between combatant and noncombatant, citizen and noncitizen; so everybody—men and women alike—must be impressed with the fact that the fate of the individual is also the fate of the nation, and vice versa. Therefore, a nation-wide organization, such as many other nations already have, must be created, because the civilian population must be fully instructed, trained, and drilled in peace time to know how to behave and defend itself individually and collectively in the event of air raids. The same naturally applies to the industry.

It might appear to some that to provide such an organization is within the province of the Government, but the experience of other nations as well as the indifference of responsible authorities demonstrate that the project can be conducted better by public-spirited, patriotic men who are willing to give their services voluntarily, because such organization can be started only by men who do not look upon it from the viewpoint of financial compensation. All responsible posts should be assigned to Reserve officers, military engineers, and militarily educated civilians who know what discipline and duty mean.

Such an organization would not serve in a warlike spirit; rather its purpose would be to distribute knowledge among the general public with regard to its own safety by eliminating, above all, the rise of a panicky mob psychology or a revolutionary movement.

The civil air defense is not only the duty and business of the civilian population, but it is the basis of its self-preservation. Only organized propaganda can warrant its success, and a prerequisite for a farsighted and successful propaganda is the existence of a strong organization. This organization should convince the American people of the vital importance of aërochemical defense and win it over to active coöperation. It should develop in the great masses those moral forces which inspire to unselfish work and sacrifice.

Since both the Army Ordnance Association and the Society of Military Engineers have a nation-wide charter and a fine membership which can be relied upon, I think they would be the most fitted for carrying out this organizational work.

New York, N. Y. LESLIE E. VELOSSY.

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### ARTILLERY AMMUNITION PRODUCTION

THE EDITOR:

The article "Artillery Ammunition Production," published in the March-April 1939 issue of ARMY ORDNANCE (Vol. XIX, No. 113, p. 273) was of particular interest. The author has shown very clearly the manufacturing problems confronting the Ordnance Department in planning for emergency production when industry must step in and without delay start a constant flow of artillery ammunition.

It is gratifying to note that in addition to showing the latest developments in production machines, tools, and material-handling equipment as used at Frankford Arsenal, the author has indicated or suggested changes in methods and design to facilitate manufacture and changes of material to improve machinability, which evidently may be made without greatly reducing the effectiveness of the projectile.

Production engineering and planning, as outlined in "Artillery Ammunition Production," is of great importance to all of us as it shows the efforts being made by the Ordnance Department to properly engineer and plan a program of immense proportions so that industry can take over with a minimum of lost motion.

In the July-August issue of ARMY ORDNANCE (Vol. XX, No. 115, p. 48) appears a discussion of "Artillery Ammunition Production," signed by "Constant Reader." Evidently "Constant Reader" is not in complete accord with the idea of applying production engineering to artillery ammunition.

With reference to a change in methods and material, the Ordnance Department can, and undoubtedly has, made tests which will definitely establish the relative effectiveness as well as safety between old and new construction. Should the new construction and material show slightly less fragmentation efficiency than the old, would it not be better and more effective in case of need to have an abundance of the less-efficient projectiles constantly coming to the ammunition loading stations, instead of a limited number of perfect ones?

Let us remember that in case of emergency, ammunition production must start at once, and it is important that we start with available material and equipment.

The fact that the cost of the projectile is only a small part of the total cost of a round of ammunition should not in the least deter the Ordnance Department from planning to economize by greatly reducing the machine-tool load and the required number of operations. Although the article "Artillery Ammunition Production" deals with the projectile only and does not make any mention of fuzes and cartridge cases, the writer would be very much surprised if these two "innocent bystanders" have not received their share of production engineering.

With reference to "Constant Reader's" last paragraph, industry has in the past few years spent considerable effort to develop machine tools and cutting tools to suit ordnance work, and a few of these machines are available at the arsenals for peace-time production. However, industry as a whole is equipped to a great extent with standard machine tools to suit particular products.

Inasmuch as the Ordnance Department must, in case of emergency, depend upon industry to assume the burden of producing the required amount of artillery ammunition as well as other Ordnance material, it would seem logical that in planning for M-day, the Ordnance Department should continue to use industry in an advisory capacity and, so far as practicable, suit designs, methods, and materials to industry's available resources, in order that mass production may be quickly obtained.

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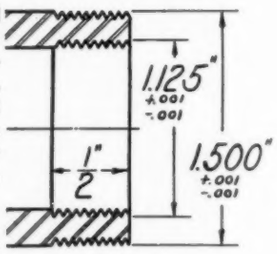


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# *Book Reviews*

Survival through War and Revolution in Russia. By D. Fedotoff White. Philadelphia: University of Pennsylvania Press. $3.00.

As an ancient saying has it, he who suffers most and survives, enjoys life best. In this long and interesting autobiographical tale of Author White, the joy of living rings through the pages. He remembers with keen pleasure his boyhood days at the naval station at Reval, his naval-academy days, the long training cruises, the classes he instructed on board, the pleasant sojourn in Washington and Newport as naval attaché of the Russian Embassy and as purchaser of munitions. With just as great zest for life, he unfolds his experiences in the Russian Revolution, in the ill-fated attempt of the so-called White armies, supported half-heartedly by the Allies, to stem the progress of the Revolution in Siberia, and finally through the early days under the Bolsheviks, until his escape to a broader and quieter life in America. It is a tale of the heights and the depths of human experience.

The following incident vividly portrays the nature of the man: When the terrific cold of the snow-covered steppes of Central Siberia carries off the men of his naval regiment by dozens, night after night, on one awful mistaken march; when disaster is following upon disaster until defeat and surrender follow, he does not omit to hold each morning the full burial service, the singing of the requiem, and the three salvos of rifle fire over the graves of those who have starved and frozen for him. It was for such things men loved him and followed him and remembered him. Characteristics like these are the ones that make for survival and explain why, among the thousands who perished, this man should be telling the story.

It is fortunate for us that one who has had such an outstanding experience should have the will to write about it and the ability to make it so thoroughly convincing and illuminating. The book is recommended as authoritative, timely, and valuable for those who are charged with law enforcement in times of crumbling governments and anarchistic disorder. For all others, it is a good yarn and an absorbing experience. C. G. M.

Attack on America. By Gen. Ared White. Boston: Houghton Mifflin Company. $2.50.

Ten years ago this tale of an armed invasion of America would have been classed with the fantastic stories of Jules Verne—or the adventures of a Buck Rogers. Today, in the light of world events, it takes on an aura of prophecy—gripping, terrifying, logical—which grows stronger with succeeding news bulletins.

A group of Central European powers are waging war on the Allied forces. They resolve that this time the United States shall not step in and turn the tide of battle. An armistice is declared during which preparations are made to invade America. Thousands of European regulars are sent to Mexico and enrolled in the Mexican Army "to preserve order." Congress and the public sneer and laugh at any suggestion of invasion.

Then suddenly the blow comes, striking the Texas border at San Antonio, finding the nation unprepared and panic-stricken. The streamlined, motorized 2nd Division is rushed in to sacrifice itself in a delaying action until mobilizaton can get under way. But this time there are no Allies to hold the lines for a year until training camps and industrial plants can begin to turn out men and matériel. "Fight and retreat" is the order of the day.

A high point of the story is reached when enemy bombers, refueling at a spy-controlled airport, fly over Washington and

bomb the White House, killing the President. One tragedy follows another. There are few antiaircraft guns or other modern weapons to combat the invader and scarcely enough ammunition to supply the existing weapons. A coalition of world powers attacks both coasts by sea. The Panama Canal is damaged, and the fleet sails around the Horn to protect the industrialized East Coast, leaving the West open to the enemy. Gradually order is brought out of chaos, and men and equipment pour forth in an ever-increasing flood finally to overwhelm the invader—but only after tremendous losses.

The author makes little attempt at characterization, letting the rapid action carry the principal character, *Benning*, a young Intelligence officer, through spy plot and counterplot with a speed that limits delineation. The story is told in crisp military style with an objectiveness and attention to detail that do much to heighten the effect of reality. Readers will find the treatment of Army organization and armament refreshingly authentic.

This book should be read by every Congressman and civic-minded American—not as a step toward spy scares and saber rattling but as a means of impressing the nation with its vulnerability to sudden attack. R. E. L.

FIGHTING FOOLS. By Brig. Gen. James E. Edmonds. New York: D. Appleton-Century Company. $2.50.

WE have not been the pacific, righteous, idealistic, and unselfish people we would like to have ourselves—and others—imagine. On the contrary, we have rushed into expeditions, wars, and conquests usually for our own gain, sometimes without excuse, and always unprepared. In our national history we have been at war more years than we have been at peace—"fighting fools."

The author's timely plea is to prevent such foolishness again. Better not get involved in war but, if we must plunge in once more, at least let us be prepared. With a dispersed Regular Army, an ill-equipped and unavoidably badly trained National Guard, and a militia almost completely unorganized, unequipped, and untrained, we are not in a position even to defend our own shores.

In view of this present state of our armed forces and the recent successes of highly mechanized and mobile troops, some of the author's proposals merit consideration. Not the most unworthy is the suggestion, reminiscent of the scheme for the French Army promulgated a year or so ago by M. Reynaud, that our Regular Army constitute itself into a mobile striking force with the National Guard as the slower-moving heavy combat force, both groups getting replacements from the draft.

In developing his theme, General Edmonds coincidentally brings up to date Upton's "Military Policy of the United States," extends Ganoe's "History of the United States Army" to the present, and adds an absorbing, if disillusioning, history of this country from the Revolution until now. C. MCK.

THE BIRD, THE GUN AND THE DOG. By Ledyard Sands. New York: Carlyle House. $7.50.

THIS is a beautiful work in all respects: conception, presentation, typography, and illustration. The author has combined twelve books in one; there is a foreword by Maj. Charles Askins; there are twenty-four plate illustrations and six original paintings by Courtenay Brandreth.

The twelve books or sections literally are twelve treatises on bird shooting. The treatment is much the same in each. For example, section X is on bay ducks, including all the diving ducks with the exception of certain sea birds treated under a separate heading, "Sea Fowl." Consideration first is given to the classification and description of various types of birds, then a discussion of natural history; *i.e.*, distribution, breeding habits, food, migration, etc.; next, methods of hunting; then the gun, its loads, various sizes of shot, manner of shooting, and finally, the dog. To the publishers, a word of congratulation—their handiwork is a thing of beauty. O. E. D.

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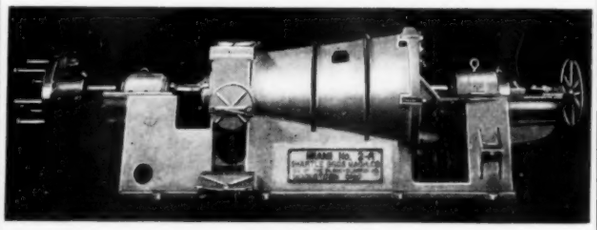

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